



APPENDIX B

HEALTH AND SAFETY PLAN

FOR THE

REMOVAL ACTIVITIES

AT

TOLEDO TIE TREATMENT SITE

LOCATED AT

ARCO INDUSTRIAL PARK

TOLEDO, OHIO

February 1998

PREPARED FOR:

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TABLE OF CONTENTS

	Page
1.0 INTRODUCTION.....	7
1.1 General.....	7
1.2 Site Location and History.....	8
1.3 Project Description.....	8
1.4 Site Access and Security.....	9
1.5 Purpose.....	9
1.6 Project Organizational Structure	11
1.6.1 Project Coordinator.....	11
1.6.2 Health and Safety Coordinator.....	11
1.6.3 Site Health and Safety Officer.....	12
2.0 HAZARD ASSESSMENT.....	13
2.1 Chemical Hazards.....	13
2.1.1 Polycyclic Aromatic Hydrocarbons (PAHs).....	16
2.2 Physical Hazards.....	16
2.3 Environmental Hazards.....	16
2.3.1 Cold Stress.....	16
2.3.1.1 Frostbite.....	18
2.3.1.2 Hypothermia.....	19
2.3.2 Heat Stress.....	19
2.3.2.1 Heat Rash.....	20
2.3.2.2 Heat Cramps.....	20
2.3.2.3 Heat Exhaustion.....	21
2.3.2.4 Heat Stroke.....	21
2.3.2.5 Additional Heat Stress Considerations.....	21
2.3.2.5.1 Thermal Burns.....	21
2.3.2.5.2 Ultraviolet Radiation.....	22

TABLE OF CONTENTS (cont.)

2.4	Biological Hazards.....	22
3.0	HAZARD ANALYSES.....	24
3.1	Free Product Recovery.....	26
3.3	Additional Hazards.....	28
4.0	HAZARD COMMUNICATION TRAINING	30
5.0	CONTAMINANT MONITORING.....	32
5.1	Site Ambient Air Monitoring.....	32
5.1.1	Oxygen Meter.....	32
5.1.2	Combustible Gas Indicator.....	32
5.1.3	Personal Air Samplers.....	33
5.1.4	Photoionization Detector.....	33
5.1.5	Additional Monitoring.....	35
5.2	Frequencies and Locations.....	35
5.3	Action Levels	35
5.4	Personnel Monitoring.....	35
6.0	SAFETY CONSIDERATIONS	37
6.1	General Safety Guidelines.....	37
6.2	Work Zones.....	38
6.2.1	Heavy Equipment/Drilling Operations.....	38
6.2.2	General Work Zones.....	39
6.3	Permit Required Confined Spaces.....	39
6.4	Trenching and Excavation.....	40
6.5	Lockhout/Tagout.....	40

TABLE OF CONTENTS (cont.)

7.0	COMMUNICATIONS	41
7.1	Off-Site Communications	41
7.2	On-Site Communications	41
7.3	Emergency Situations	41
8.0	PERSONNEL PROTECTIVE SAFETY GEAR	42
8.1	Level C Protection	42
8.2	Level C Modified Protection	42
8.3	Level D Protection	43
9.0	DECONTAMINATION AND CLEANUP PROCEDURES	44
9.1	Personnel Decontamination	44
9.2	Equipment Decontamination	45
9.3	Site Cleanup	45
10.0	EMERGENCY RESPONSE	46
10.1	General	46
10.2	Emergency Phone Numbers and Hospital Directions	46
10.3	Typical First Aid Procedures for Chemical Exposure	47
10.3.1	Inhalation	47
10.3.2	Skin/Eye Contact	47
10.3.3	Ingestion	47
10.4	Fire Prevention/Emergency Response	48
11.0	MEDICAL SURVEILLANCE	49
11.1	General	49
12.0	SITE MANAGEMENT	50
12.1	Control of Contaminated Materials	50

TABLE OF CONTENTS (cont.)

12.1.1 Personnel Protective Equipment.....	50
12.1.2 Equipment Decontamination.....	51
<u>12.2 Traffic Control.....</u>	<u>51</u>
<u>12.3 Personnel Control.....</u>	<u>51</u>

LIST OF FIGURES

Figure 1-1 Site Location Map	10
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LIST OF TABLES

Table 2-1 List of TLVs and PELs for Compounds of Concern.....	14
Table 4-1. Action Levels	34

ATTACHMENTS

Attachment A Quick Reference Guide for Field Personnel	
Attachment B Personnel Acknowledgement to HASP	
Attachment C Material Safety Data Sheets	
Attachment D Confined Space Entry Supplement	
Attachment E Trenching and Excavation Supplement	
Attachment F Energy Control	
Attachment G Emergency Telephone Numbers and Map to Hospital	
Attachment H Accident Illness/Injury Investigation	

NOTICE TO HEALTH AND SAFETY PLAN USER

Hull & Associates, Inc. (HAI) intends for this HASP to provide a general overview of basic health and safety concepts that are routinely encountered and implemented at a typical site involving remedial action of hazardous and non-hazardous contamination. These guidelines are not intended to address all types of hazards which may arise, and they do not include controls and response guidelines in sufficient detail to handle all emergencies or other unusual site conditions. All questions and clarifications regarding the material in this HASP, in addition to questions pertaining to health and safety issues not covered in this manual, should be directed immediately to the local site Project Coordinator and/or Health and Safety Coordinator in the Toledo HAI office at (419) 241-7171.

This Health and Safety Plan is prepared for Hull & Associates, Inc. employees, subcontractors, representatives, and visitors. This plan will be reviewed and understood by HAI's subcontractors, representatives, and visitors working at a particular site; however, employers have the ultimate responsibility for providing a safe and healthy work environment for its employees. As such, HAI assumes no responsibility for ensuring proper implementation of the HASP, or for documenting required worker training, proper air monitoring protocol, or decontamination procedures for its subcontractors, representatives, or visitors.

1.0 INTRODUCTION

1.1 General

Hull & Associates, Inc. (HAI), has been retained by Kerr-McGee Chemical, LLC, to create this Health and Safety Plan (HASP), in accordance with the Unilateral Administrative Order (UAO) issued by the United States Environmental Protection Agency (U.S. EPA). This HASP has been prepared with the intention to provide health and safety guidelines for all of the projected remedial activities to be conducted at the former Toledo Tie Treatment Site, located in Toledo, Ohio, in the Arco Industrial Park.

The property is occupied by several local businesses that may be in contact with the known or suspected areas of contamination. These businesses are located around or in the vicinity of the Toledo Tie Treatment Site, hereafter referred to as the "Site". All applicable safety precautions shall be taken to assure that there is no potential for a hazardous release (i.e., dermal contact, inhalation, ingestion etc.) to the public, on-site workers, visitors, or the environment. While the closest residential area is approximately one-quarter of a mile away, all necessary security measures shall be implemented to control the Site and ensure public safety and welfare. This HASP also addresses health and safety guidelines for activities to be completed with respect to the time critical areas of contamination, as well as the Engineering Evaluation and Cost Analysis (EE/CA).

This HASP is fairly complex and lengthy due to anticipated site conditions and nature of the planned activities. To facilitate use by on-site personnel, a quick reference field guide detailing the more important and most used portions of this plan is located in Attachment A. This attachment may be removed and distributed to field personnel prior to commencement of field activities and after personnel have read this complete HASP and acknowledged their understanding of this HASP, by their signature as required under Attachment B.

1.2 Site Location and History

The former Toledo Tie Treatment Site is an abandoned wood-preserving site that utilized coal tar creosote from 1923 to 1962. The Site is located in the City of Toledo, Lucas County, Ohio, and identified by the approximate coordinates of 41 degrees 38' 00" North latitude and 83 degrees 37' 05 West longitude. A site location map is presented in Figure 1-1. The Site encompasses approximately fifty acres, with the most heavily contaminated zones being the waste lagoons, Williams Ditch, and the former creosoting tank farm. The Site is surrounded by areas zoned commercial and light industrial, and is known as Arco Industrial Park. The general project area is bounded by Hill Avenue to the north, Arco Drive to the west, Frenchman Road to the south and Conrail railroad tracks to the east. Williams Ditch flows from southwest to northeast across the interior of the Site, ultimately discharging to Schneider ditch and the Ottawa River.

first I've heard of this

1.3 Project Description

In general, the objectives of this plan are to address the health and safety issues that affect employees during remedial abatement measures and anticipated site activities, including:

1. free product recovery;
2. installation of siphon dams and containment mechanisms;
3. investigative sampling, monitoring, and documentation;
4. on-site waste removal and/or relocation, as needed;
5. general work activities;
6. Construct soil erosion and sediment control measures;
7. Temporary road construction; and
8. Erection of security fencing and/or other site control mechanisms.

pg Removal

A detailed discussion of individual project tasks is included in the Remedial Work Plan.

pretty tentative

1.4 Site Access and Security

Keys to the gates shall be provided to the U.S. EPA, Ohio EPA, and the local fire and police departments if a permanent chain-link fence is constructed. Employee and equipment access shall be maintained through a designated gate area, if applicable. Signs shall be placed on the fence indicating site control measures. The signs may state "Danger, Keep Out, or Caution." The fencing shall be inspected on a weekly basis, or more frequently, and repaired when necessary.

Personnel shall understand that all activities, data, documents, etc. are confidential and intended for use by Kerr-McGee Chemical, LLC, the U.S. EPA, the Ohio EPA, and those parties so designated by Kerr-McGee legal counsel. If approached by persons from the community or other unauthorized visitors, field personnel shall request that the person's questions be directed to the immediate Site manager or the Project Coordinator and escorted to an unwarranted area. All equipment, materials, and vehicles are the sole responsibility of the owner(s).

1.5 Purpose

The specific purpose of this HASP is to detail the applicable engineering, administrative, and protective provisions which shall be followed to help ensure that the health and safety of the surrounding community, site personnel, and visitors is adequately. It also fulfills the applicable regulations mandated by the Occupational Safety and Health Administration (OSHA), U.S. EPA, and Ohio EPA including, but not limited to:

1. 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response);
2. 29 CFR 1910.1200 (Hazard Communications);
3. 40 CFR 264.54 and 1905.08(d)(4)(i) (EPA Contingency Planning); and
4. 29 CFR 1926, Construction Industry Standards, including Subpart P (Excavations).

1.6 Project Organizational Structure

The following briefly describes the organizational structure and responsibilities of various personnel relative to administration of the health and safety program.

1.6.1 Project Coordinator

The Project Coordinator shall be responsible for directing all required site activities in conjunction with the UAO. The Project Coordinator shall be readily accessible and present on-site when possible, during site work. This person should also, when possible, coordinate decisions that potentially affect employee health and safety with the Health and Safety Coordinator.

1.6.2 Health and Safety Coordinator (HSC)

The HSC shall work closely with the Project Coordinator and Project Manager(s) to ensure that all work is carried out in the safest manner possible. The HSC shall be responsible for ensuring the overall implementation and enforcement of this HASP. This person may also be responsible for certifying appropriate air monitoring procedures and personal sampling methods, as needed. The HSC shall work with the Project Managers and field personnel to prevent occurrences where employees are exposed to contaminant concentrations above the corresponding permissible exposure limits (PELs) or threshold limit values (TLVs), whichever is lower. The HSC shall have the authority to stop any phase of the project deemed dangerous to human health and the environment and/or not in substantial compliance with this HASP.

1.6.3 Site Health and Safety Officers (SHSO)

Project SHSOs shall be responsible for implementing the provisions of this plan during work activities. They shall also have the authority to stop work in case a significant safety or health concern develops. However, only HSC or Project Coordinator can order work to begin again. SHSOs are responsible for the daily enforcement of this HASP. They shall also be responsible for conducting any necessary air monitoring, accident or incident investigating/reporting, contractor/employee compliance procedures, and any other health and safety-related duties. Ultimately, the SHSOs shall ensure that all project activities are conducted in a safe manner.

2.0 HAZARD ASSESSMENT

2.1 Chemical Hazards

The objective of this section is to identify the types of hazardous materials that may be encountered during each phase of the remedial work plan. Several compounds were identified in various media during previous sampling events conducted by the Ohio Department of Health and the Ohio Environmental Protection Agency. The media sampled included surface and subsurface soils, surface water, ground water, and water sediment. Creosote and creosote derivatives were the primary chemical hazards identified. Creosote is normally yellow to black in color and can have a specific gravity greater than, or less than that of water. In many cases, the product shall be found at the surface as well as the subsurface level. Additionally, small amounts of other potentially hazardous substances may be present at the site that have not yet been identified. These chemical hazards involve substances which may exhibit one or more of the following characteristics: toxicity, ignitability, reactivity, or corrosivity. Material Safety Data Sheets (MSDSs) for these compounds can be found in Attachment C. If additional compounds are known to exist at the Site, MSDSs for those compounds shall be supplied as well.

Most activities shall be performed outside, and shall be conducted in a manner to ensure limited exposure to contaminated media. Air monitoring requirements shall be based on knowledge of site conditions, previous site data, and current site data. Air sampling shall be performed before and periodically during all potential exposure situations, as applicable. If air monitoring action levels are exceeded, further administrative and engineering controls shall be implemented to reduce personnel exposure to airborne contaminants. If action levels are still exceeded, appropriate personal protective equipment shall be provided to potentially affected personnel.

Table 2-1 PEL & TLVs

PARAMETER	PEL-TWA	TLV-TWA	STEL	IDLH	LEL
Phenanthrene	.2 mg/m ³	.2 mg/m ³			
Naphthalene	50 mg/m ³	50 mg/m ³		500 ppm	
Acenaphthene					
Benzo(a)pyrene	.2 mg/m ³ A2			700 mg/m ³	None Reported
Fluoranthene					
Pyrene	.2 mg/m ³	None established			None Reported
Chrysene	.2 mg/m ³				
Dibenzo(a,h)anthracene	.2 mg/m ³				
Coal Tar Creosote	.2 mg/m ³	.2 mg/m ³	---	700 mg/m ³	None Reported

Threshold Limit Value or Permissible Exposure Limits - Time Weighted Average (TLV or PEL - TWA): the time weighted average concentrations for a normal eight hour workday or forty hour work week to which nearly all workers may be repeatedly exposed day after day, without adverse effects. PELs are enforceable OSHA standards. TLVs are recommended guidelines developed by the American Conference of Governmental Industrial Hygienists (ACGIH).

STEL - Short Term Exposure Limit: the maximum concentration to which it is felt the average worker can be exposed for a period of up to fifteen minutes continuously without adverse effects. Exposures above the PEL or TLV up to the STEL should not be longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures.

IDLH - Immediately Dangerous to Life or Health: represents maximum concentration from which in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape - impairing or irreversible health effects.

(-) No value found or not applicable

(S) - Skin - Contribution to the overall exposure via the cutaneous route including mucous membranes and eyes

Ca - Suspected or confirmed human carcinogen

A2 - Suspected human carcinogen

ppm - parts per million of contaminant by volume

(SA) - simple asphyxiant - may displace oxygen in concentrated exposures or confined spaces

LEL - lower explosive limit in air

- inhalation of polynuclear aromatic hydrocarbons(PAHs) compounds, dusts, VOCs, and other contaminants present in ambient air;
- absorption of liquid or vapor through skin (particularly eyes, mucous membranes, and feet);
- dermal contact with surface soils, surface water and sediments, and water sediments;
- incidental ingestion of contaminated surface water and soil through poor personal hygiene and poor use of PPE; and
- injection of contaminants through skin (cuts, scrapes, etc.)

OSHA has established permissible exposure limits (PELs) and ACGIH has established threshold limit values (TLVs) for exposure to airborne concentrations of substances. These guidelines represent conditions under which it is expected that nearly all personnel may be repeatedly exposed daily (8-hour time-weighted average) without adverse health effects. Established levels have been listed in Table 2-1 for the compounds which may present a potential hazard to personnel at the Site. The TLV or PEL representing the lowest contaminant level shall be used as the exposure guideline. One-half the TLV or PEL, whichever is lower, shall be used as the action level when monitoring for specific contaminants.

The acute (short-term, immediate) symptoms of exposure to the various anticipated chemical hazards are similar between hazards. In general, acute symptoms of exposure that may occur in certain individuals include the following:

- | | | |
|---------------------------------------|----------------------------|-------------------------|
| 1. eye, nose, and throat, irritation; | 5. Nausea; | 9. Fatigue; |
| 2. headache; | 6. Respiratory irritation; | 10. Staggered gait; and |
| 3. euphoria; | 7. Confusion; | 11. Skin irritation. |
| 4. giddiness | 8. Weakness; | |

2.1.1 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, or other organic substances. PAHs are also found in coal tar, crude oil, and creosote. The other common observations in possible creosote toxicity cases are the carcinogenic and toxic effects of PAHs contained in creosote. PAHs may be released when creosote is exposed to high temperatures or pressures. PAHs normally have a low human toxicity with slight, if any, mutagenic effects. However, PAH metabolites or derivatives may act as strong mutagens and their interactions with DNA are believed to be carcinogenic.

2.2 Physical Hazards

Physical hazards associated with the project include working outside (heat or cold stress), manual labor, working in or around traffic, working in moderately rough terrain, working near a body of water, and working near heavy equipment. Field personnel must take extra precautions when walking, working, or operating vehicles on unstable, rough, or slippery ground. The specific hazards and their associated safety precautions are identified according to the type of work being conducted in Section 3.0, Hazard Analyses. The primary physical hazards to employees involves working on the steep and slippery ditch banks and with or near heavy equipment. All employees should pay particular attention to moving equipment. When working in areas where equipment operators visibility may be compromised for any reason, the use of spotters and hand signals is recommended.

2.3 Environmental Hazards

2.3.1 Cold Stress

Cold stress can occur during cool or cold weather when personnel are not adequately dressed or when they perspire while wearing protective clothing. Personnel shall be encouraged to bring dry clothes and change into them when necessary. Personnel must be aware of the potential for frostbite during cold periods. Proper clothing must be worn and adequate work breaks given to allow personnel to warm up. The SHSO shall determine the required actions to assure personnel safety during cold periods. These actions shall be based on site-specific conditions (wind, rain, etc.). The following

symptoms are indications of overexposure to cold conditions and require immediate attention:

- Pain or numbness in the extremities are the first early warning of danger to cold stress;
- Development of severe shivering, which indicates that exposure to cold should be immediately terminated;
- Decreased manual dexterity, indicating extremity overexposure; and
- Feelings of excessive fatigue, drowsiness, irritability, or euphoria, which require an immediate heating shelter.

Cold stress conditions are significantly worsened by lowered air temperatures, increased wind velocity, and exposure to wet conditions. The following precautions should be followed:

- Workers should bring extra dry clothes and change into them immediately when needed. Wet clothing, including both outerwear wet from rain or snow and innerwear wet from sweating, should be removed immediately prior to entering or re-entering cold conditions.
- Avoid exposed skin and wet clothing which shall enhance the potential for frostbite.
- Wear many individual layers of clothing rather than a few bulky layers.
- Workers must be allowed adequate work breaks to warm body parts.
- Be aware that wind, snow, and rain may exacerbate cold conditions.
- Recognize that individual cold tolerances may vary.
- Protect susceptible areas such as feet, hands, nose, and ears.
- Workers with circulatory problems may require special precautionary protection against cold injury such as reduced exposure period.
- A heater such as a car heater or heated building must be nearby to warm hands or other body parts. (**Remember: Pain in hands and/or feet signifies initial stages of frostbite!**)
- Adequately insulated dry clothing must be worn when temperatures are below 40°F.

- Coffee intake should be limited because of diuretic and circulatory effects. However, adequate liquid intake (e.g., warm, sweet, non-caffeinated drinks and soups) should be maintained.
- Insulated gloves should be worn when working with metal tools or metal parts in cold weather.
- If clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until weather conditions improve.

For work in cold conditions less than 40°F workers must:

- use the buddy system and watch partner for signs of frostbite or hypothermia;
- limit work rate to avoid sweating;
- minimize sitting still or standing still for long time periods;
- avoid work in extremely cold conditions (generally less than 20°F);
- protect themselves from drafts of open areas, if possible; and
- not be required to work full-time in the cold generally during the first week of adjustment to conditions until workers can become accustomed to such working conditions; remember that individual adjustments to cold working conditions can vary significantly.

2.3.1.1 Frostbite

Cause: Exposed skin and extremities (i.e., not well insulated parts of the body) have a tendency to freeze in cold temperatures, especially when wet from perspiration, rain, snow or submergence in water.

Symptoms: The skin turns red or pink and pain is experienced in the early stage of frostbite. As frostbite develops, the skin may become a dull white or grayish yellow and may feel cold and numb. The victim may not feel pain in the later stages. Skin may blister.

Care: Cover the affected parts with dry insulated materials and transport victim to an indoor heated area immediately. Do not rub affected parts in snow or submerge parts in cold water. Submerge in luke-warm water (approximately 100 degrees Fahrenheit) until skin is pink. Do not use hot water or hold over an open flame or stove to warm exposed parts. Injured parts should be loosely bandaged. Keep affected parts elevated. Immediately consult a physician anytime that frostbite is suspected.

2.3.1.2 Hypothermia

Cause: Exposure to extreme cold that causes the entire body to chill or freeze. Hypothermia, complete chilling of the body, is often associated with drenching or extensive perspiration in a cold environment.

Symptoms: Victims may experience shivering, numbness, weakness in the muscles and joints, and a low body temperature. The victims pulse and breathing rates decrease. The victim may seem drowsy and he/she may possibly become unconscious. Eventually, death may occur.

Care: Transport the victim to a warm environment immediately. Remove all wet and restricting clothing and wrap the victim in dry, warm blankets or garments. **Consult a physician immediately.**

2.3.2 Heat Stress

Another important safety consideration is heat stress. Heat stress results when the body cannot cope with the increased stress of working in a hot environment. Personnel wearing protective clothing have an increased potential for heat stress because clothing inhibits the body's natural cooling mechanism, the evaporation of perspiration. Dehydration, profuse sweating, and strenuous work conducted under such conditions can lead to heat stress. The following precautions should be taken when working in a potential heat stress environment:

- drink plenty of liquids to avoid dehydration;
- drink approximately one-pint of water prior to commencing work;
- at each break, drink tepid water and/or electrolyte fluids;
- wear light-colored, cool clothing;

- take frequent work breaks;
- if possible, work during the cooler hours of the day, and avoid strenuous work between 10 am and 2 pm; and
- protect exposed skin from ultraviolet (UV) exposure by frequently applying sunscreen, especially between the hours of 10 am and 2 pm when the most UV damaging rays are present.

Working in hot environments can cause several recognized physical injuries, which in order of increasing severity include: heat rash, heat cramps, heat exhaustion and heat stroke.

2.3.2.1 Heat Rash

Cause: Heat rash is caused by unrelieved exposure to hot humid air. The skin's sweat pores become clogged, thus causing a skin rash to appear. Covered skin is particularly vulnerable, although dried sweat over exposed skin can cause salt crystal buildup and subsequent eye and skin irritation.

Symptoms: Red rash, impaired sweating, mild discomfort, lowered heat tolerance.

Care: Allow victim to rest in cooler environment. Give victim water to drink. Wash skin with cool water.

2.3.2.2 Heat Cramps

Cause: Heat cramps, while debilitating, are easily reversible if properly and promptly treated. Caused by profuse sweating with inadequate replacement of water and salt.

Symptoms: Muscle spasms and pain in abdominal muscles and extremities.

Care: Allow victim to rest in cooler environment. Give victim at least four ounces of water every fifteen minutes for an hour.

2.3.2.3 Heat Exhaustion

Cause: Temporary condition which results from physical exertion in hot environment; profuse sweating without proper evaporation and dehydration can occur. Nervous system control and heart output is inadequate to meet demands of heat and dehydration. Heat exhaustion can lead to heat stroke if not treated properly.

Symptoms: Pallor, faintness, dizziness, temporary loss of breath, profuse sweating, clammy/cool skin, dilated pupils, headache, nausea and vomiting.

Care: Allow victim to rest in cooler environment and remove higher his/her protective clothing. Give the victim at least four ounces glass of water every 15 minutes if he/she is conscious and can tolerate it. Place the victim in the shock position (lying down with feet elevated). Cool victim by fan or applying wet towels or sheets etc. Monitor closely. Transport victim to medical facility if there are no signs of improvement.

2.3.2.4 Heat Stroke

Cause: The most serious of heat-induced illnesses is heat stroke because of its potential to be life threatening or to result in irreversible damage. Heat stroke results from excessive physical exertion in a hot environment. **This is a serious problem and can be fatal.** The strain placed on the circulatory system can cause victim to go into shock.

Symptoms: Dizziness, nausea, severe headache, constricted pupils, hot dry skin, cessation of sweating, high temperature (usually 100°Fahrenheit and rising), confusion, collapse, delirium, coma, staggering gait, convulsions, unconsciousness.

Care: Transport victim immediately to a medical facility. If body is not cooled immediately, irreversible damage to vital organs may develop leading to death. Take victim to a cooler and uncontaminated area and remove protective clothing. **Do not give victim anything to drink.** Cool victim with cold water, cold compresses, and rapid fanning.

2.3.2.5 Additional Heat Stress Considerations

2.3.2.5.1 Thermal Burns

Additional precautions must be considered when working in areas with considerable solar loads. Black or dark nonreflective surfaces can become extremely hot and may cause burns if exposed to unprotected skin. In addition, wide open dark surfaces, such as asphalt/blacktop parking lots, can create excessive radiant walking surfaces, which, if ignored, can cause

profuse foot perspiration and discomfort as well as increase potential for heat stress-related illnesses. When touching potentially hot surfaces, lined or unlined cotton or leather gloves are generally recommended. When working on hot open surfaces, employees may wish to carry additional socks and change them when necessary.

2.3.2.5.2 Ultraviolet Radiation

Certain employees not normally acclimatized to direct solar radiation are susceptible to severe sun burns, if unprotected. Employees should bring sunscreen (SPF-15) with them if they are particularly prone to burning or if they shall be outside working for a significant amount of time. The hazards of heat stress and thermal/ultraviolet burns can be severe and debilitating. All employees should monitor one another, particularly unacclimatized employees.

2.4 Biological Hazards

Biological hazards are living organisms that can cause illness or death to exposed individuals. Plants that elicit allergic skin reactions in sensitive individuals, such as poison ivy, oak and sumac, are such biological hazards and may be present at any site located outdoors. Personnel should avoid stepping in areas where such vegetation may exist. Plastic sheeting can be used to reduce contact with vegetation, if work must be conducted in these areas. Even when not transmitting disease or producing allergic response, insects and other invertebrates can produce painful stings and bites; bees, wasps, fire ants and biting flies all fall into this category. The presence of flying, biting insects can also produce potentially dangerous field conditions because of the distraction they may cause to site workers.

Common sense can mitigate most biological hazards in field and sampling situations. Insect and invertebrate hazards may be reduced by the use of repellents where appropriate. Extreme care should be taken to avoid air, soil, or water contamination with any repellent.

If bee or wasp nests are encountered when conducting work in a nesting area, the use of a carbon dioxide extinguisher shall temporarily incapacitate the insects until the nest can be physically removed using remote mechanical means, such as a long stick or branch. Taping or tying pant legs and shirt sleeves shut lessens ant and tick bite hazards. Plants which may cause allergic reactions in field personnel should be identified and removed or avoided.

3.0 HAZARD ANALYSES

Hazard: Contact with contaminated soils, ground water, or non aqueous phase liquids (NAPL)

Precautions:

- Use layered latex and nitrile gloves when handling samples.
- Use layered latex and nitrile gloves when handling heavily contaminated soils.
- Always wear long pants.
- Wash hands thoroughly prior to eating, drinking, smoking, or applying cosmetics.
- If skin contact is made, immediately wash affected part with soap and water.
- Properly dispose of contaminated materials.
- Remove contaminated clothing as soon as possible.
- Always treat all materials handled as if they are contaminated.

Hazard: Inhalation of Dust or Gases

Precautions:

- Containerize contaminated soils immediately.
- Keep sample(s) away from face area. Do not smell sample for evidence of contamination.
- Obtain/use an air purifying respirator

Hazard: Flying debris.

Precautions:

- Safety glasses with side shields and hard hats shall be provided and should be worn by all project personnel.
- Personnel shall avoid working in areas that may be affected by flying debris.

Hazard: Inclement weather

Precautions:

- Work shall be ceased during thunderstorms with lightning and/or any other severe weather (i.e., tornado, hail, snow, etc).

Hazard: Traffic control

Precautions:

- Contact local authorities (e.g., traffic engineers/street departments) for appropriate safety requirements.
- Operate vehicles at safe speeds especially when working in rough terrain.
- Use cones, blockades, flashing signs, etc. when working near roadways or in high traffic areas.

Hazard: Noise exposure

Precautions:

- Hearing protection shall be provided to employees and shall be worn when levels exceed 85 dBA.

Hazard: Moving equipment and parts

Precautions:

- Steel-toed boots and hard hats are required when working around heavy equipment.
- Protective gloves should be worn when working with tools or equipment which could potentially cut or pinch fingers or hands.

3.1 Ground-water Sampling Procedures

Hazard: Skin contact with contaminated ground water

Precautions:

- Latex and nitrile gloves shall be worn when sampling surface water; gloves should be layered to provide greater protection from skin absorption.
- Hands, arms, face, and neck shall be thoroughly washed with soap and water prior to eating, drinking, smoking, or applying cosmetics.
- Areas of skin contacted by ground water shall be washed with soap and water immediately.
- Care shall be taken to avoid spilling/splashing surface water from the ditch.
- Do not place hands directly into surface water without proper glove protection.
- Assume that all surface water is contaminated.

Hazard: Inhalation of air contaminants

Precautions:

- Keep face (breathing zone) away from contaminated media to avoid breathing gases that may be emanating from the material.
- Minimize the amount of time that is spent in the vicinity of contamination.
- Avoid smelling surface water or media as a means of determining degree of contamination.
- If any symptoms of overexposure occur, work should be stopped immediately and the HSC and/or Project Coordinator contacted.

3.2 Free Product Recovery

Hazard: Contact with free product material

Precautions:

- Free product recovery shall be conducted by the contractor, using their standard procedures. Extra precautions shall be taken when conducting free product recovery procedures due to the high potential for direct contact with the contaminant.
- While conducting recovery efforts on the slopes of the ditch, personnel shall wear a safety harness with an attached lanyard. The buddy system shall be implemented whenever feasibly possible.
- Forearm-length nitrile gloves shall be worn; gloves shall be discarded if any signs of glove degradation is evident.
- *Sarnex Poly Tyvek* suits and sleeve protectors shall be worn when needed.
- Avoid all skin contact with free product or surface water.
- Any liquid contact with skin shall immediately be followed by a thorough washing and rinsing.
- Hands, arms, neck, and face shall be thoroughly washed prior to eating, drinking, smoking, or applying cosmetics.
- All materials, equipment, etc. shall be decontaminated following use and all PPE properly disposed of in a plastic container. Contaminated clothing should be removed as soon as possible.
- As needed, *Visqueen* shall be placed around the work area to avoid spilling product on ground.

Hazard: Inhalation of VOCs

Precautions:

- Personnel shall stand upwind of product when possible.
- Personnel shall take breaks away from the contaminated area.
- If any symptoms of overexposure occur (e.g., headache, nausea, etc.), personnel shall immediately leave the recovery area and contact the HSC and/or Project Coordinator.

Hazard: Fire/explosion

Precautions:

- Ignition sources shall be removed from any potentially flammable area.
- Non-intrinsically safe or non-explosion proof electrical devices should **NOT** be used in areas where a potential for fire/explosion exists.

Hazard: Exposure to soil contaminants

Precautions:

- Do not smell soil for evidence of contamination.
- Avoid breathing vapors from excavations with contaminated soil and surface water.
- Keep all ignition sources away from the contaminated area.
- Use appropriate personal hygiene when working around contaminated materials.

3.3 Additional Hazards

Hazard: Traffic Concerns

Precautions:

- Be conscious of all personnel on-site.
- Do not drive closer than four feet of the ditch edge.
- Keep vehicle use to a minimum when possible.

Hazard: Water/Drowning

Precautions:

- Always use the "buddy system".
- Avoid entering water unless necessary.

- PFDs may be required at the discretion of the health and safety coordinator.

Hazard: Excessive Vegetation

Precautions:

- Be conscious of hidden trip hazards.
- Avoid poison ivy, poison sumac, poison oak, mold, and fungi.

Hazard: Eating, drinking, smoking, or use of tobacco products

Precautions:

- To avoid the unnecessary ingestion of hazardous chemicals, there shall be no use, or the consumption of, the previously mentioned items in the designated work zones
- Prior to consumption of food or tobacco products personnel shall properly decon with soap and water

Hazard: Unanticipated environmental and/or health and safety consideration

Precautions:

- Should any site personnel anticipate or recognize a potential safety or health hazard they should immediately report their concerns to the SHSO, HSC, Project Coordinator, or on-site supervision

4.0 HAZARD COMMUNICATION AND TRAINING

Field personnel must be knowledgeable about hazards to which they may be exposed during this project, as required by the OSHA Hazard Communication (HAZCOMM) Standard and the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard.

A comprehensive Hazard Communication and Training program requires at least the following elements:

- meetings with personnel involved in this project about hazards which may be encountered at the work Site (including contractors, subcontractors, and visiting personnel);
- proper and adequate employee training in required hazard communication and hazardous waste operations and emergency response topics (OSHA 40 Hour Training Course);
- training regarding the understanding of container labeling and required material safety data sheets (MSDSs);
- review of the location of MSDSs and labels for substances found on-site (MSDSs can be found in Attachment C);
- review of the site-specific HASP and the Hazard Communication program; and
- a site-specific orientation/safety and health session including:
 1. site layout and accessibility
 2. hand signals/communication requirements
 3. safety rules and recognition of potential hazards
 4. personal hygiene
 5. chemical and physical hazards
 6. work hazards
 7. work zones
 8. contingency/emergency planning
 9. air sampling

10. protective equipment
11. traffic rules
12. excavation precautions
13. confined space entry precautions

Training programs shall meet all OSHA or other applicable regulations. Also, safety briefings shall be given daily or as needed by the HSC, the SHSO, or a designee when new or unanticipated activities occur. All on-site personnel required to wear respirators shall be fit tested and instructed in the proper use, cleaning, storage, and limitations of their respirators. A list documenting the date, time and persons attending each health and safety meeting shall be filed with the applicable HSC.

All personnel shall be required to acknowledge their training via the form in Attachment D. Contractors or other on-site visitors must have similar programs in effect prior to entering the Site.

The specific training requirements (for personnel and supervisors/managers at hazardous waste sites) published under 29 CFR 1910.120, Standards for Hazardous Waste Operations and Emergency Response, include:

1. 40 hours of initial training (certified course) plus three days of actual field experience under the direct supervision of a trained, experienced supervisor for general Site personnel;
2. 24 hours certified training plus one day direct field experience under a trained supervisor for personnel with occasional, limited on-site tasks who, based on the discretion of the HSC, shall not likely be exposed over a TLV or PEL (e.g., surveyors, equipment operators, etc.); and
3. an additional eight hours of specialized training for manager/supervisors in addition to the 40-hour training.

5.0 CONTAMINANT MONITORING

5.1 Site Ambient Air Monitoring

The SHSO shall be responsible for all on-site air monitoring. This sampling shall in many cases be real time (direct reading) in nature due to the constantly changing conditions that may be encountered during site work. Air monitoring shall be conducted for the following parameters:

1. semi-volatile organics
2. dust, particulate matter (PM-10 and Total Suspended Particulates (TSP));
3. oxygen content (for confined space conditions);
4. flammable or explosive atmospheres, and as necessary;
5. toxic substances (hydrogen sulfide, hydrogen cyanide, etc.)

5.1.1 Oxygen Meter

Oxygen content should be measured as percent oxygen in air with 21.9 percent being normal. Oxygen levels below 19.5 percent or above 23.5 percent are considered hazardous. It is important to note that when oxygen levels are below 19.5 percent, LEL readings shall be inaccurate.

5.1.2 Combustible Gas Indicator

With regard to flammable or explosive atmospheres, concentrations are measured with a combustible gas indicator (CGI) as "percent of the lower explosive limit" or percent LEL. While levels in the range of zero percent to twenty percent of the LEL are normally considered safe, ten percent LEL shall be the action level as an increased safety factor. It should be noted that organic vapors can still be present above safe level at the ten percent LEL Level. A low LEL reading should not be interpreted as a safe condition in other terms of potential health effects to exposed, unprotected personnel. Also, if CGI readings exceed that of the lower explosive limit, a zero meter reading shall be observed. If a high concentration of gas (i.e., a concentration above the LEL) is suspected, a percent gas meter with an extended sampling probe in which the area can be monitored from a

remote, safe area must be used to verify the presence of a combustible/non-combustible atmosphere.

5.1.3 Personal Air Samplers

With regard to the safety of the public during site activities, personal air monitoring equipment may be placed at the perimeter of the site and monitored by a designated representative. Taking into account changing weather patterns (i.e., wind direction) the air monitors shall be adjusted/repositioned, as needed, in order to achieve the most representative and accurate sample.

5.1.4 Photoionization Detector

Exposures to toxic substances in air shall be monitored on a regular basis during the anticipated site activity. Hand-held direct reading monitors, such as a *HNu* or ToxiRAE photoionization detectors (PID), shall be utilized to sample for volatile, toxic organic substances. Exposure to toxic gases shall be kept at a minimum. Action levels for volatile organic compounds using a PID are provided in Table 4-1. These levels are conservative and take into account that many direct reading detectors, such as the PID, detect total organics and cannot differentiate between compounds. Also, the action level takes into account that a PID meter reading may not be the actual concentration of contaminants present in parts per million (ppm); rather the actual concentration present may be significantly greater than the observed reading. It is important to remember that PIDs cannot detect the presence of methane gas, an ambient air constituent detected previously at the Site. Therefore, the conservative action level takes into account that the presence of methane shall significantly decrease PID meter response to ionizable semi-volatile and volatile organics. A LEL/O₂ meter should be used to detect flammable atmospheres resulting from methane and to estimate the amount of gas present.

The use of a particular sampling device must be matched to the results desired. For instance a PID depends on the ionization potential of a chemical for a response to that substance. If the ionization potential exceeds the lamp output, then the meter shall not react to that substance. An example is a PID with a 10.2 eV lamp that would not react to 1,1,1-trichloroethane which has an ionization potential greater than 11.0 eV. In the case just cited, a PID with a ionization potential of 11.7 eV or a

TABLE 5-1

**TOLEDO TIE TREATMENT SUPERFUND SITE
HEALTH AND SAFETY PLAN**

ACTION LEVELS

MONITORING EQUIPMENT	MEASURED LEVEL	ACTION
Oxygen Meter	< 19.5%	Cease all operations, leave work area, and contact HSC or SHSO.
	19.5% - 23.5%	Continue work. Deviation from normal level may be due to the presence of other substances.
	> 23.5%	Cease all operations, leave work area, and contact HSC or SHSO. Potential fire hazard may exist.
Explosive/Combustible Meter ^b	0-10% LEL ^c	Continue work.
	10-20% LEL ^c	Leave confined space (if applicable) and revoke entry permit. Monitor excavations and other combustible areas on a continual basis using extreme caution if higher levels are obtained. Continue work.
	> 20% LEL	Cease all operations. Leave work area, and contact HSC or SHSO. Potential explosion hazard may exist.
PID, OVA, FID, length of stain or other similar sampling instrument	0-5 ppm ^a	Continue work.
	5-50 ppm ^a	Modified Level C Protection (half-face respirator) is required.
	50-100 ppm ^a	Level C Protection (full face air-purifying respirator) is required.
	> 100 ppm ^a	Cease all operation, leave work area, and contact HSC, or SHSO.

a - Reading above background levels and in breathing zone.

b - Combustible gas readings are not valid in atmosphere with < 19.5% oxygen.

c - Only the HSC can authorize re-entrance into a confined space or an area where a previous explosion hazard existed.

d - Note: Negative pressure respirators are not approved for, or recommended for protection against H₂S.

Drager tube designed specifically to detect 1,1,1-trichloroethane is an appropriate monitoring device. An 11.7 eV lamp shall be used because detectable concentrations of chlorinated compounds, many which require use of an 11.7 eV lamp, have previously been noted at the Site.

5.1.5 Additional Monitoring

- Miniram (respirable particulate matter)
- Compur SD 4100 (hydrogen cyanide)
- 3M Organic Vapor Badges (organic vapors)

5.2 Frequencies and Locations

Frequencies and locations of monitoring shall be determined using a common sense approach by the SHSO in conjunction with the HSC, on an as needed basis.

5.3 Action Levels

The levels of protection and action levels for personnel safety are outlined in Table 4-1. It is anticipated that work shall be conducted in Level D environments unless conditions warrant increased personal protective equipment. Air monitoring may indicate the need for a higher level of protection. Based on additional information acquired throughout the course of the project, these levels may be revised by the HSC to reflect changing conditions. Changes in the action levels shall be instituted by the HSC through the SHSO. Field personnel shall be notified of any changes.

5.4 Personnel Monitoring

If concentrations of PAHs is greater than five ppm above background are detected via direct reading instruments in the breathing zones of personnel, the use of full-face respirators shall be implemented. Additional monitoring may be conducted as deemed necessary by the HSC using vapor badges or other substance-specific, personal air sampling methods. These methods shall determine the average (including peak and low) concentrations of specific present in the work area over a specified length of time and near the actual breathing zone. If the initial round of monitoring reveals that airborne

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5.1

contaminant concentrations remain less than one-half of the respective TLV, then sampling shall be decreased to less frequent monitoring. If monitoring indicates concentrations of over one-half of the TLV, then monitoring shall be conducted daily until concentrations of less than one-half the TLV are maintained on a regular basis, as determined by the HSC. If concentrations at or above the TLV for a specific compound exist and administrative or engineering controls cannot be used to reduce exposure below acceptable exposure levels, personal protective equipment (i.e., respiratory protection) shall be modified accordingly. The additional modification shall be made by the HSC or SHSO and shall take into account contaminant concentrations, health effects and associated respiratory protection factors (RPFs). All decisions shall be documented accordingly.

A background reading is a measurement taken in an area where low or non-detectable concentrations would be expected (e.g., ten to twenty feet upwind of any source where no detectable concentration is suspected to exist). It should be noted that background readings on various instruments can be dependent on factors such as high humidity and temperature.

10. use of contact lenses by personnel are not allowed during any activities when using respirators or when in areas where irritating gases may become trapped underneath lenses;
11. wearing a respirator shall require the removal of all facial hair except small mustaches that are within the sealing surface of the respirator;
12. changes in contingency plans shall be posted to notify all personnel of any modifications to safety protocols related to changing Site conditions;
13. no open flames shall be allowed inside the exclusion zone (i.e., smoking). Intrinsically safe or explosion proof equipment shall be used in potentially explosive atmospheres;
14. when in doubt, withdraw and re-assess when encountering any potentially hazardous situation;
15. be aware that chemical constituents may mimic or enhance symptoms of other illnesses or intoxication;
16. the SHSO shall maintain a log of meetings, facts, incidents, data, etc. relating to the project. Records shall remain at the Site for the duration of the project, if feasible; and
17. observance of applicable OSHA, EPA, general health and safety, and specific equipment use practices is mandatory.

6.2 Work Zones

6.2.1 Heavy Equipment/Drilling Operations

All phases of work are anticipated to be conducted in Level D personnel protective equipment. However, the Site shall maintain designated work zones to provide for the general safety of personnel. A safe radius shall be maintained around any drilling equipment, field study equipment, or other heavy equipment. Only required personnel shall be in the immediate proximity of operating equipment.

6.0 SAFETY CONSIDERATIONS

6.1 General Safety Guidelines

All personnel shall be expected to adhere to the safety practices for their respective tasks. Personnel shall also exercise caution when working in adverse weather, on rough or slippery terrain, when operating on or around machinery, and when vision and mobility are impaired due to use of protective gear. It is also important that the integrity of protective clothing be maintained and personnel realize the increased difficulty in communicating when wearing a respirator (if use is necessary). The following should be noted:

1. in unknown situations, always assume the worst and plan responses accordingly;
2. use the buddy system; establish and maintain communication by use of hand signals, radios or other means, as necessary;
3. minimize contact with excavated or other potentially hazardous materials or liquids. Do not place equipment on tanks, drums, or the ground. Never sit or climb on tanks, drums, or other vessels and containers;
4. use disposable protective items when possible to minimize risks during work;
5. smoking, eating, or drinking is not allowed after entering the work zone and before personal decontamination. Hands should always be washed prior to smoking, eating, or drinking;
6. work breaks should be planned to prevent stress related accidents, fatigue, or heat or cold stress symptoms;
7. conflicting situations between work requirements and safety procedures must be resolved by HSC and/or SHSO;
8. unauthorized breaches of specified safety protocol shall not be allowed. Personnel unshalling to comply with established safety procedures shall not be allowed to continue to work at the Site;
9. be observant of the surroundings and also of others. Extra precautions are necessary when using protective gear due to reduced vision and hearing;

6.2.2 General Work Zones

During project operations, the Site shall be divided into three zones. These zones are the exclusion zone, contamination reduction zone (CRZ), and support zone. The exclusion zone is the immediate work area where possible exposure to contaminants may occur and where tasks such as sampling, air monitoring etc. are conducted. In this case, the exclusion zone shall consist of the ditch, ditch bank, or any other immediate source of contamination where work is being conducted. The exclusion zone shall be marked with plastic barrier tape attached to stanchions to prohibit unauthorized, untrained individuals from entering the potentially hazardous area. The CRZ shall consist of an area where personnel from the exclusion zone shall enter to discard their equipment and disposable PPE and where decontamination shall take place prior to entering the support zone. If Level C PPE is warranted and approved, the CRZ shall serve as a PPE doffing area. The support zone shall be located outside the CRZ and the exclusion zone. The support zone is an area where Level D personnel protective gear is required and Level C gear is immediately available. In this area there should be no exposure to potential contamination.

Again, due to the low hazard potential in many areas of this project, the use of full Level C protection shall not be needed unless preliminary air monitoring indicates otherwise, but shall be available on-site for immediate use.

6.3 Permit-Required Confined Spaces

The nature of this project and investigative techniques should not require personnel to enter confined spaces such as manholes, sewers, tanks, excavations, etc. Personnel are prohibited from entering confined spaces during the course of this project unless specifically authorized by the HSC or SHSO.

If during the project it is apparent that entry into a permit-required confined space (PRCS) is necessary, the HSC shall be informed and the proper PRCS procedures including an entry permit system shall be implemented. Only the HSC or SHSO can determine whether or not a confined space is a PRCS and can authorize entry. Details regarding entry into a PRCS and permit forms are located in Attachment F.

6.4 Trenching and Excavation

The Occupational Safety and Health Administration (OSHA) issued its first Trenching and Excavation Standard in 1971 to protect personnel from excavation hazards. OSHA has amended the standard several times to reduce the frequency and severity of excavation accidents and injuries, though excavation related accidents resulting in injury and fatality continue to occur.

OSHA has completely revised its existing standard to simplify many of the provisions, clarify definitions, eliminate redundant provisions and ambiguous language, and give employers flexibility in providing protection for employees. The standard is 29 CFR Part 1926, Subpart P, and became effective FEBRUARY 5, 1990. A summary of applicable guidelines and a copy of the new regulations can be found in Attachment F.

As trenching and excavating may be a necessary activity in this project, it shall be conducted in a safe manner and according to all applicable regulations.

6.5 Lockout/Tagout

Working with electrically energized equipment (e.g., pumps, controls, fans, etc.) or other equipment where energy can be stored and subsequently released poses the need for unique safety considerations. Such considerations should be part of an overall energy release control program sometimes called lockout/tagout which can be found in Attachment F.

7.0 COMMUNICATIONS

7.1 Off-Site Communications

Communications between on-site and off-site personnel may be maintained by the following:

1. Public Pay Telephone - Public pay telephones may be located near the Site.
2. Portable Telephone - A portable telephone shall be located in the project area or in the nearest vehicle.

7.2 On-Site Communications

Communications between on-site personnel may be maintained by using portable two-way radios. If no portable radios are used, hand or voice signals shall be used to communicate between personnel on-site. The following hand signals shall be used when hearing is a problem:

- Hands on Throat -- Out of Air.
- Grip partners wrist or hands on hips -- Leave area immediately.
- Thumbs up -- OK; I'm alright.
- Thumbs down -- Negative; there is a problem.

7.3 Emergency Situations

A hand-held air horn or similar means of communication shall be available on-site to alert personnel in the event of an emergency situation. Once the emergency signal has been given, the designated evacuation procedures as discussed in section 9.0 shall be followed.

8.0 PERSONNEL PROTECTIVE SAFETY GEAR

8.1 Level C Protection

It is anticipated that all work shall be performed using Level D personnel protective safety gear. However, if Level C work is deemed necessary and authorized by the HSC or SHSO, equipment shall include:

1. full-face air purifying respirators equipped with a combination organic vapor/HEPA particulate cartridges;
2. chemical resistant clothing, one piece, long sleeved and hooded;
3. outer nitrile work gloves and latex undergloves;
4. chemical resistant outer boots and inner disposable booties;
5. a hard hat; and
6. hearing protection for personnel on/around the drill rig or heavy equipment.

Boots and gloves shall be taped to chemical resistant coveralls.

8.2 Level C Modified Protection

If air monitoring indicates acceptability, Level C Modified personnel protective safety gear shall be used when authorized by the HSC or SHSO and shall consist of:

1. half-face air purifying respirators equipped with combination organic vapor/HEPA particulate cartridges;
2. safety glasses or chemical resistant goggles;
3. chemical resistant clothing, one piece, long sleeved and hooded;
4. outer nitrile work gloves and latex undergloves;

5. chemical resistant outer boots and inner disposable booties;
6. a hard hat; and
7. hearing protection for personnel on/around the drill rig.

Boots and gloves shall be taped to chemical resistant coveralls.

8.3 Level D Protection

If conditions permit, all work on this project shall be conducted in Level D personnel protective safety gear consisting of:

1. coveralls (disposable coveralls may be desirable);
2. safety boots (if applicable) or sturdy, slip-resistant shoes;
3. safety glasses or goggles (if liquid splash hazard exists);
4. a hard hat;
5. work gloves (chemical resistant when contact with contamination is anticipated); and
6. ear protection for personnel on/around heavy equipment, etc.
7. sarnex or poly-tyvek suits and latex and nitrile gloves and booties shall be worn when working in the exclusion zone

NOTE: No personnel shall be allowed to wear a respirator when facial hair interferes with the seal. Also, all personnel shall be individually qualitatively or quantitatively fit tested for their respirator before the job begins according to OSHA protocol and/or provide the proper documentation that a fit test has been conducted.

Initially, administrative and engineering controls shall be implemented to reduce exposure potential. Precautions such as working upwind of potentially contaminated areas, prohibiting personnel from working in these areas, and sampling from remote locations shall be used to eliminate potential exposure hazards. If controls cannot reduce hazards below PELs or TLVs, then Level B PPE shall be required in areas with elevated exposure concentrations. If Level B PPE is required, an amendment to this section shall be made to detail the requirements of Level B PPE.

9.0 DECONTAMINATION AND CLEANUP PROCEDURES

9.1 Personnel Decontamination

Decontamination shall be carried out by all personnel leaving the exclusion zone. Under no circumstances, except for emergency evacuation or medical emergencies, shall contaminated personnel or equipment be allowed to leave the contamination reduction zone without following proper decontamination procedures. The following procedures, shall be performed:

1. tools, air monitoring instrumentation, sampling equipment, and trash shall be placed at designated stations (stations shall contain designated containers for depositing trash and plastic sheeting for placing equipment and instruments prior to decontaminating);
2. outer gloves and boots shall be removed;
3. tape and boots shall be removed;
4. outer gloves shall be removed and placed in a designated container;
5. hard hat shall be removed;
6. outer garments shall be removed and discarded in a designated container;
7. inner gloves shall be removed and placed in a designated container; and
8. respirator shall be removed and placed in a designated area, if needed.

Because some workers may not be entering the exclusion zone, personnel decontamination procedures shall consist only of placing used chemical-resistant gloves in a plastic container and washing hands thoroughly prior to eating, drinking, or smoking.

9.2 Equipment Decontamination

Equipment decontamination shall be conducted in a manner that assures all contaminants remain on-site and potentially contaminated equipment/materials are properly stored (e.g., overpack drums, plastic containers, etc.). Decontamination of large equipment shall occur in a designated area within the contamination reduction zone or the outer most section of the exclusion if feasible. Decontamination of sampling equipment or other small equipment shall be conducted in each individual working area within the exclusion zone.

Monitoring equipment shall be protected from contamination as much as possible. This may be done by storing instruments in a background area, draping with plastic, or covering instruments with plastic bags so as not to hinder operation. After sampling completion, covers shall be disposed of and the instruments internally purged and cleaned with disposable paper towels.

Respirators shall be cleaned daily with respirator disinfectant, alcohol, or other appropriate disinfecting solution, such as wetted paper wipes. At the beginning of each day, respirators shall be inspected for possible disfunction or leaks, repaired as necessary, and re-assembled. New respirator cartridges shall be installed as needed or when breakthrough is suspected. Each person shall be responsible for his or her own respirator adjustments and care. Decontamination of larger equipment (e.g., trucks, drilling rigs, etc.) is discussed in section 11.0 of this document.

If heavy equipment becomes contaminated with waste while cutting or drilling, it shall be removed with a shovel or trowel in a safe manner.

9.3 Site Cleanup

The SHSO and/or Project Coordinator shall ensure that the Site is left in a clean and orderly condition. All disposable clothing, excess materials, and other debris shall be properly containerized and removed from the Site unless it is contaminated. All contaminated materials shall be properly managed and disposed of accordingly after appropriate characterization.

10.0 EMERGENCY RESPONSE

10.1 General

Some of the potential emergencies associated with this project include areas containing hazardous vapors, heavy equipment (e.g., excavator, etc.) related accidents, exposure to temperature extremes, accidents associated with various hand tools or sampling equipment, working around contaminated media, working near excavations, and working where potential for slips and falls exists.

It is anticipated that unless air monitoring indicates otherwise, all work shall be performed using Level D protection. Work areas shall be restricted as discussed in Section 6.0. Exclusion zones shall be used for all work to prevent unauthorized, untrained individuals from entering work areas. Individual zones may be used for convenience to properly segregate operations and keep unauthorized personnel out of work areas. If a hazardous level of vapor exists or accidentally occurs, personnel shall leave the work area in the upwind direction as appropriate.

All personnel injuries, regardless of severity, shall be reported to the HSC and SHSO as soon as possible. If the injury is minor and does not require off-site treatment, first aid can be administered and the SHSO shall determine if the victim can continue working. If the injury requires medical attention, the individual shall receive immediate care. The HSC will be notified and the proper procedures shall be conducted. The required accident/injury reporting forms shall also be completed.

10.2 Medical Emergency

Medical emergency information is included in Attachment H and consists of written directions to the hospital, a map, and emergency phone numbers. These numbers shall be posted at a designated location at the work site. In the case of a serious injury, an ambulance or emergency medical service shall be summoned via the portable telephone. A company vehicle with appropriate first aid supplies should always be on-site for less serious injuries.

10.3 Typical First Aid Procedures for Chemical Exposure

10.3.1 Inhalation

1. remove victim from toxic atmosphere;
2. clear airway;
3. immediately contact supervisor; and
4. seek medical attention.

10.3.2 Skin/Eye Contact

1. remove clothing where chemical has spilled;
2. skin contact - flush area for 15-30 minutes;
3. deep skin burns - flush area for 15-30 minutes;
4. eye splashes - flush area for 15-30 minutes;
5. cover the burns with a dressing;
6. immediately contact supervisor; and
7. seek medical attention.

10.3.3 Ingestion

1. immediately contact supervisor;
2. follow instruction listed on MSDSs or label.

In all the above cases, the MSDS or label information should be checked for more specific first aid information. If exposure is suspected and exposure symptoms exist, prompt medical attention for victim shall be obtained immediately.

10.4 Fire Prevention/Emergency Response

Standard fire prevention techniques shall be utilized in addition to those afforded by the local fire department including:

1. locating portable fire extinguishers in appropriate vehicles, out-buildings and major site work areas (e.g., excavations). In an area where the possibility of a flammable atmosphere exists, a fire extinguisher should be located in the nearest building or vehicle;
2. designating fire and emergency routes (primary and alternate) for all unique work areas;
3. instructing personnel on fire and emergency contingencies at pre-construction meetings and other safety training sessions, including the use of fire extinguishers;
4. implementing communication protocols detailed in Section 7.0 of this HASP; and
5. posting emergency numbers and routes at an easily accessible location.

11.0 MEDICAL SURVEILLANCE

11.1 General

Personnel of various contractors shall be working at this site. According to OSHA employers are responsible for their own employees, regardless of the prime contractors, subcontractors, or site owners involved in the project. All employers whose employees may potentially be exposed to waste materials, hazardous materials, or other occupational hazards, shall establish a medical surveillance program for their employees in accordance with the requirements of 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response), and other applicable regulations.

Contractors may be asked to verify that their employees are currently under an occupational medical monitoring program.

12.0 SITE MANAGEMENT

12.1 Control of Contaminated Materials

Contaminated materials that may be generated include, but are not necessarily limited to, decontamination solutions, disposable equipment (e.g., protective clothing), contaminated purge water, material collected from a backhoe, etc. Circumstances which may result in these materials being distributed throughout the Site include:

1. contaminated soils adhering to heavy equipment and personnel;
2. conveyance via airborne particulates generated from site activities;
3. uncontrolled stormwater or wash water spreading contaminated materials and surface water to other areas; and
4. spills from containers during transport or transfer.

12.1.1 Personnel Protective Equipment

If personnel are exposed to airborne contaminant levels exceeding five parts per million (ppm) above background as determined with detector tubes, photoionization detectors, OVAs, a portable GC, etc., or if there is potential for contaminated material to be splashed on personnel, disposable protective clothing shall be designated as contaminated and shall be disposed of properly after use. Contaminated clothing and disposable personnel protective equipment shall be placed in plastic bags. The plastic bags shall be stored in drums and properly staged until disposal arrangements are made.

12.1.2 Equipment Decontamination

Backhoes, trucks, drill rigs, containers, and other heavy equipment shall be void of any soils, sludge, or other debris before leaving the contamination reduction zone. A high pressure steam sprayer may be used to decontaminate those pieces of equipment directly in contact with contaminated media. A high pressure steam sprayer may be used to decontaminate equipment before entering or leaving the Site.

12.2 Traffic Control

Heavy equipment, drill rigs, personal/company vehicles, and other equipment shall follow specific traffic rules. Pedestrians at the Site shall be given the right-of-way and shall be avoided by heavy equipment operators. Minimum traffic speeds shall be maintained around the site to avoid excess generation and to provide safety to pedestrians and equipment operators. Areas where heavy equipment is operating shall be avoided by unauthorized personnel.

12.3 Personnel Control

The SHSOs shall retain a daily sign-in log for all personnel and visitors at the Site which shall record the date, firm, reason for visit, and name.

ATTACHMENT A

Quick Reference Guide for Field Personnel

QUICK REFERENCE GUIDE FOR FIELD PERSONNEL

1.0 Introduction

This quick reference guide is designed to be used independently of the HASP and to convey the most important and most used portions of the HASP to field personnel. It is not intended to replace the HASP, which must be kept at the Site for review, acknowledgement and reference at all times. The entire HASP must be reviewed thoroughly by all applicable personnel as part of the training requirements. This guide shall augment and highlight specific engineering, administrative, and protective provisions made to ensure the safe and healthful execution of this project.

2.0 Physical Hazards

2.1 Key Concerns and Items to Remember

Always be alert to symptoms of **COLD** or **HEAT STRESS**. Know the symptoms and remedies for frostbite, hypothermia, heat rash, heat cramps, heat exhaustion, and heat stroke.

- Don't warm cold body parts in hot water or snow, use lukewarm water only.
- Keep victim calm.
- In hot environments, drink 1/2 glass of water every 15 minutes for cases of heat cramps or heat exhaustion.
- Take periodic rest breaks.
- Consult physician or transport victim to hospital if a possibility exists that frostbite, hypothermia, or heat stroke has occurred.

When working around the following conditions:

- Slippery, rough, snow, or ice covered surfaces - Wear appropriate slip-resistant foot gear and take extra precautions. Also, watch out for vehicles and traffic around the Site and for entrance and exit areas.

- Drilling equipment - Always be alert to equipment locations and potentially dangerous situations. Keep unnecessary personnel a safe distance from the drilling location.

Always remember:

- Avoid contact with potentially contaminated soils, liquids, etc. If contact is required to collect samples, the appropriate type of gloves shall be worn.
- Use the buddy system. Be alert to any potential hazards.
- Assume the worst and plan accordingly when approaching unknown situations. Withdraw from suspected hazardous situations and reassess the situation before reentering.
- Wear appropriate levels of personal protective equipment (including hearing protection).
- No smoking, eating, or drinking inside the exclusion zone or contamination reduction zone.
- Unauthorized breeches of safety protocol are prohibited.
- Wear and use clean respirators as indicated and store according to protocol.
- Contact lenses are not to be worn by persons wearing respirators, sampling wells, or in any other situations where irritating gases may become trapped beneath the lense.

3.0 Sampling of Airborne Constituents

- Air sampling shall be performed in all designated work areas for potentially hazardous airborne substances.
- Monitoring shall be accomplished via real-time direct reading methods (PID, OVA, CGI, O₂, etc.); however, specific contaminant monitoring may be used to identify a specific compound if deemed necessary by the HSC.

- Initial trigger levels are (additional Action levels are listed on the attached Table A-1):

Total VOCs > 5 ppm above background
LEL > 10 percent in confined spaces; >20 percent in excavations
H₂S > 5 ppm; HCN > 5 ppm
O₂ < 19.5 or > 23.5 percent in air
- Personal air sampling may be performed if ambient air concentrations appear to stay above 3 ppm as measured using a PID or OVA. Organic vapor badges or other methods may be used as directed and analyzed for individual components.
- The ambient air around each activity location shall be sampled before, during, and after work. One and six foot levels above ground and at height of release shall be monitored. The area at various distances from the activities shall be scanned regularly (for instance, hourly) using a common sense approach based on readings found and on previously discovered constituents for each location.
- Instruments will be calibrated and used according to manufacturers' specifications. Readings from uncalibrated or improperly calibrated instruments will not give valid measurements.
- All sample and calibration data shall be recorded in a site-specific, bound log.
- All work is anticipated to be in Level D (coveralls, safety boots, safety glasses/goggles, hard hat, gloves, and hearing protection (when necessary)).
- All work in the CRZ and exclusion zone shall be conducted in *sarnex/polytyvek* suits, layered latex gloves and nitrile outer gloves, hard hat, safety glasses, and disposable booties.
- All personnel conducting work along the ditch and on the slopes of the ditch shall wear an approved safety harness.

NOTE: Use a full-face air purifying respirator with a combination organic vapor/HEPA particulate filter cartridge whenever inhalation hazards or other compounds with extremely low TWAs are confirmed or suspected. Supplied air shall be used if levels of hydrogen sulfide and hydrogen cyanide are above their corresponding TLVs or PELs. The HASP shall be upgraded in that case.

TABLE A-1
SANITARY LANDFILL COMPANY SUPERFUND SITE
HEALTH AND SAFETY PLAN
ACTION LEVELS

MONITORING EQUIPMENT	MEASURED LEVEL	ACTION
Oxygen Meter	< 19.5%	Cease all operations, leave work area, and contact HSC or SHSO.
	19.5% - 23.5%	Continue work. Deviation from normal level may be due to the presence of other substances.
	> 23.5%	Cease all operations, leave work area, and contact HSC or SHSO. Potential fire hazard may exist.
Explosive/Combustible Meter ^b	0-10% LEL ^c	Continue work.
	10-20% LEL ^c	Leave confined space(if applicable) and revoke entry permit. Monitor excavations and other combustible areas on a continual basis using extreme caution if higher levels are obtained. Continue work.
	> 20% LEL	Cease all operations. Leave work area, and contact HSC or SHSO. Potential explosion hazard may exist.
PID, OVA, FID, length of stain or other similar sampling instrument	0-5 ppm ^a	Continue work.
	5-50 ppm ^a	Modified Level C Protection (half-face respirator) is required.
	5-100 ppm ^a	Level C Protection (full face air-purifying respirator) is required.
	> 100 ppm ^a	Cease all operation, leave work area, and contact HSC, or SHSO.
H ₂ S Meter ^d	0-5 ppm	Continue on-site monitoring with extreme caution as higher levels are encountered
	> 5 ppm	Cease all operations, leave work area, and contact HSC or SHSO. Potential health hazard exists.

a. ~ Reading above background levels and in breathing zone.

b. ~ Combustible gas readings are not valid in atmosphere with < 19.5% oxygen.

c. ~ Only the HSC can authorize re-entrance into a confined space or an area where a previous explosion hazard existed.

d. ~ Note: Negative pressure respirators are not approved for, or recommended for protection against H₂S.-

5.0 Points to Remember

- A 2-way radio and air horn must be on-site at all times.
- Hand Signals include:

Hands on throat -- I'm out of air.

Grip partners wrist or hands on hips -- Leave area immediately.

Thumbs up -- OK; I'm alright.

Thumbs down -- Negative; There is a problem.

- Emergency phone numbers and a map to the hospital are included as Attachment H to the HASP (Appendix B). A company vehicle shall always be on-site.
- Report all injuries or illnesses, including all minor injuries, to the HSC or SHSO.

6.0 Key Personnel

Project Coordinator	Peter Goetz
Project Manager	Scott Lockhart, P.E.
Health & Safety Coordinator	Gary D. Lescallett
USEPA On-Scene Coordinator	Ralph Dollhopf
USEPA Remedial Project Manager	Deborah Orr

ATTACHMENT B

Personnel Acknowledgement to Health and Safety Plan

ATTACHMENT C

Material Safety Data Sheets



Genium Publishing Corporation

1145 Catalyn Street
Schenectady, NY 12303-1836 USA
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Material Safety Data Sheets Collection:

Sheet No. 757
Coal Tar Creosote

Issued: 7/91

Section 1. Material Identification

34

Coal Tar Creosote (molecular formula varies with purity) Description: Three main derivations: by distillation of coal tar produced by high-temperature carbonization of bituminous coal; by mixing strained naphthalene oil, wash oil, and strained or light anthracene oil; as a by-product of conventional coal coking. It typically contains up to 160 chemicals, mainly aromatic compounds such as phenol, pyrol and pyridine. Used mainly as a wood preservative for railroad ties, poles, fence posts, marine pilings, and other lumber for outdoor use; as a water-proofing agent, fuel oil constituent, frothing agent for mineral separation, hop defoliant, and lubricant for die molds; in manufacturing chemicals; and in medicine as an antiseptic, disinfectant, antipyretic, astringent, germicide, and styptic.

Other Designations: CAS No. 8001-58-9, Awpa,® brick oil, Caswell No. 225,® coal tar oil, creosote, creosote oil, creosotum, cresylic creosote, heavy oil, liquid pitch oil, naphthalene oil, Preserv-o-sote,® Sakresote,® tar oil, wash oil.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*™ for a suppliers list.

Cautions: Flammable, liquid coal tar creosote is toxic by inhalation, ingestion, and skin contact. The IARC and NTP classify it as a *human carcinogen*.

* Skin absorption can occur with phenol, a major component of coal tar creosote.

R	1	NFPA
I	4	
S	4*	
K	2	
	* Skin absorption	
		HMIS
		H 2
		F 2
		R 0
		PPG†
		† Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Coal tar creosote, ca 100%

1990 OSHA PEL
3-hr TWA: 0.2 mg/m³*

1990-91 ACGIH TLV
TWA: 0.2 mg/m³*

1987 IDLH Level
700 mg/m³

1990 NIOSH REL
0.1 mg/m³ (cyclohexane extractable portion)

1985-86 Toxicity Data†

Rat, oral, LD₅₀: 725 mg/kg; toxic effects not yet reviewed

Dog, oral, LD₅₀: 600 mg/kg; toxic effects not yet reviewed

Rat, TD₀₁: 52,416 mg/kg administered during 91 days prior to mating produces reproductive effects on fallopian tubes and ovaries

Mouse, skin, TD₀₁: 99 g/kg produces tumors in skin and appendages

* As coal tar pitch volatiles.

† See NIOSH, RTECS (GF8615000), for additional mutation, reproductive, tumorigenic, and other toxicity data.

Section 3. Physical Data

Boiling Point: 381 to 752 °F (194 to 400 °C)

Distillation Range: 446 to 554 °F (230 to 290 °C)

Heat of Combustion: -12,500 Btu/lb

Heat of Vaporization: 107 Btu/lb

Molecular Weight: Varies with purity

Density/Specific Gravity: 1.07 to 1.08 at 68 °F (20 °C)

Water Solubility: Slightly soluble

Appearance and Odor: Pure coal tar creosote is colorless, but the industrial product is a yellow to black oily liquid with an aromatic smoky smell and a burning caustic taste.

Section 4. Fire and Explosion Data

Flash Point: 165.2 °F (74 °C), CC

Autoignition Temperature: 637 °F (336 °C)

LEL: None reported

UEL: None reported

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO₂), or regular foam. For large fires, use fog or regular foam. Since water is least effective, use it as an extinguishing agent only when the preferred measures are unavailable. However, use water spray to cool fire-exposed containers.

Unusual Fire or Explosion Hazards: Vapors may travel to an ignition source and flash back. Containers may explode in heat of fire. Coal tar creosote presents a vapor explosion hazard indoors, outdoors, and in sewers.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Immediately leave area if you hear a rising sound from venting safety device or notice any fire-caused tank discoloration. Isolate area for 1/2 mile in all directions if fire involves tank, rail car or tank truck. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Fully decontaminate or properly dispose of personal protective clothing.

Section 5. Reactivity Data

Stability/Polymerization: Coal tar creosote is stable at room temperature in closed containers under normal storage and handling conditions.

Hazardous polymerization: cannot occur.

Chemical Incompatibilities: Creosote oil mixed with chlorosulfonic acid in a closed container causes an increase in temperature and pressure.

Conditions to Avoid: Avoid excessive heat and contact with chlorosulfonic acid.

Hazardous Products of Decomposition: Thermal oxidative decomposition of coal tar creosote can produce oxides of carbon and thick, black, acrid smoke.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA list coal tar creosote as a carcinogen.

Summary of Risks: Coal tar creosote is toxic by inhalation, ingestion, and skin contact. It contains a variety of hydrocarbons such as phenol and polycyclic aromatic hydrocarbons such as benzo[a]pyrene, benzanthracene, and phenol derivatives. The range of toxicity depends on the exposure concentration, amount, and duration. Effects may include irritation, burns, and several forms of cancer.

Medical Conditions Aggravated by Long-Term Exposure: Chronic respiratory or skin diseases.

Target Organs: Eyes, skin, bladder, kidneys, and respiratory system.

Primary Entry Routes: Inhalation, ingestion, and skin contact.

Acute Effects: Skin contact may cause irritation, burning, itching, redness, pigment changes, dermatitis (a rash of redness and small bumps), or burns. Photosensitization (worsening of rash with exposure to sunlight) may occur. Inhalation may be irritating to the respiratory tract. Eye contact may cause conjunctivitis (inflammation of the eye's lining), keratitis (corneal inflammation), or corneal burns with scarring. Ingestion may result in nausea, vomiting, abdominal pain, rapid pulse, respiratory distress, and shock. Systemic absorption by any route (including skin absorption) may cause trouble breathing, thready (continuous or drawn out) pulse, dizziness, headache, nausea, vomiting, salivation, and convulsions. Exposure to large doses (particularly by ingestion) may be fatal.

Chronic Effects: Dermatitis, skin cancer, and lung cancer.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Do not let victim rub eyes or keep them tightly closed. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Wash affected area with soap and flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of milk or water. Do not induce vomiting!

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Cresol may be detected in urine.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate hazard area, deny entry, and stay upwind of spills. Shut off all ignition sources—no flares, smoking, or flames in hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If possible with no risk, stop leak. Water spray may be used to reduce vapor but it may not prevent ignition in closed spaces. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal. For large spills, dike far ahead of liquid spill for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

Environmental Degradation: Coal tar creosote is fouling to shoreline. Ecotoxicity values are: TL₅₀, goldfish (*Carassius auratus*), 3.51 ppm/24 hr (60:40) mixture of creosote and coal tar; LD₅₀, bob white quail (*Colinus virginianus*), 1,260 ppm/8 days (60:40) mixture of creosote and coal tar.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

PA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Material No. U051

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per RCRA, Sec. 3001]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

SHA Designations

Listed (as coal tar pitch volatiles) as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.**

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent all skin contact. Applying a layer of petroleum jelly or lanolin castor oil treatment to the face reduces vapor contact and penetration through skin. Frequent change of protective garments is an additional protective measure.

Ventilation: Provide general and local exhaust ventilation systems equipped with high-efficiency particulate filters to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Take particular care to avoid any contamination of drains or ventilation ducts. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in a cool, dry, well-ventilated area. Store coal tar creosote as close to area of use as possible to minimize transporting distance.

Engineering Controls: Use engineering controls to keep airborne concentrations below the OSHA PEL. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Always perform synthesis and purification procedures under a vertical ventilation hood and make regular operational safety checks. Label doors to rooms where coal tar creosote is produced, used, or stored as containing a carcinogen. Locate emergency equipment at well-marked and clearly identified stations in case emergency escape is necessary.

Other Precautions: Preplacement and periodic medical examinations of exposed workers emphasizing respiratory, skin, liver, and kidney disorders, including comprehensive work and medical history, physical examination, CXR, PFTs, urinalysis, LFT, and sputum cytology as the attending physician considers appropriate. Educate workers about coal tar creosote's carcinogenicity and proper handling procedures to avoid exposure.

Other Comments: Caution is in order when handling or sawing old creosote-treated lumber since it retains a considerable portion of creosote for 10 to 25 to 30 years.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Creosote

DOT Hazard Class: Flammable liquid

UN No.: UN1136

DOT Label: Flammable liquid

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 142, 143, 146, 148, 153, 159

Prepared by: M Gannon, BA; Industrial Hygiene Review: DJ Wilson, CH; Medical Review: Mark Upfal, MD, MPH; Edited by: JR Stuart, MS



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Material Safety Data Sheet Collection

Phenanthrene

MSDS No. 905

Date of Preparation: 6/94

Section 1 - Chemical Product and Company Identification

44

Product/Chemical Name: Phenanthrene

Chemical Formula: $(C_6H_4CH)_2$

CAS No.: 85-01-8

Synonyms: Phenanthrin

Derivation: A polynuclear aromatic hydrocarbon found as a component of coal tar pitch volatiles (products of bituminous coal distillation). Produced from toluene, bibenzil, 9-methyl fluorene or stilbene by passage through red hot tubes or by diene synthesis of 1-vinyl naphthalene and maleic anhydride.

General Use: Used in the manufacture of dyestuffs and explosives; in biological research or drug synthesis.

Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Phenanthrene, ca 100 % wt

OSHA PEL*

8-hr TWA: 0.2 mg/m³

ACGIH TLV*

TWA: 0.2 mg/m³

NIOSH REL*

10-hr TWA: 0.1 mg/m³, cyclohexane
extractable fraction

DFG (Germany) MAK

None established

*Coal tar pitch volatiles (benzene soluble)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Phenanthrene exists as shiny crystals with a faint, aromatic odor. It can cause photosensitization of the skin. Phenanthrene is combustible and reacts dangerously with oxidizers.

Potential Health Effects

Primary Entry Routes: Skin contact.

Target Organs: Skin.

Acute Effects

Inhalation: Effects not reported.

Eye: Effects not reported.

Skin: Can cause photosensitization of the skin.

Ingestion: Effects not reported.

Carcinogenicity: Although it has produced skin cancer in experimental animals, the results were not statistically significant and IARC has assigned phenanthrene a Class 3 (unclassifiable as to carcinogenicity) designation. The NTP and OSHA do not list phenanthrene as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.

Chronic Effects: None reported.

**Wilson
Risk
Scale**

R 1
I 3
S 3
K 1

HMIS

H 1
F 1
R 0

PPE*

*Sec. 8

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin Contact: Quickly remove contaminated clothing. Rinse exposed area with flooding amounts of water to remove loose material and then move quickly to a soap and water wash. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: 340 °F (171 °C)

Flash Point Method: OC

LEL: Not reported.

UEL: Not reported.

Flammability Classification: Class IIIB Combustible liquid

Extinguishing Media: Use dry chemical or carbon dioxide; water spray or foam may cause frothing.

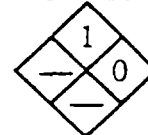
Unusual Fire or Explosion Hazards: None reported

Hazardous Combustion Products: Carbon oxides (CO_x) and acrid smoke

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

NEPA



Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against skin contact.

Small Spills: To avoid dust generation, *do not sweep!* Carefully scoop up or vacuum (with appropriate filter). Damp mop residue.

Large Spills

Containment: Flush large spill to containment area for later disposal. Do not release into sewers or waterways.

Cleanup: Mop up any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use nonsparking tools to open containers.

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and strong oxidizers.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around phenanthrene.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL

(Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29

CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendation is for

coal-tar pitch volatiles: For any detectable concentration, use a SCBA or supplied-air respirator (with auxiliary SCBA) with a

full facepiece and operated in pressure-demand or other positive pressure mode. For emergency or nonroutine operations

(cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in**

oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at

least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and

convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or

repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations

(29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in

conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this

material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before

eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Colorless, shiny crystals with a faint, aromatic odor.

Vapor Pressure: 1 mm Hg at 244.76 °F (118.2 °C);

400 mm Hg at 586.4 (308 °C)

Formula Weight: 178.22

Density (H₂O=1, at 4 °C): 1.179 g/L at 77 °F (25 °C)

Water Solubility: 1.6 mg/L at 59 °F (15 °C)

Other Solubilities: 1 g in: 2.4 mL toluene, 2.4 mL carbon tetrachloride, 2 mL benzene, 1 mL carbon disulfide, 25 mL absolute alcohol, 60 mL cold 95% alcohol, 10 mL boiling 95% alcohol and 3.3 mL anhydrous ether. Also soluble in glacial acetic acid, chloroform, and hot pyridine.

Boiling Point: 644 °F (340 °C)

Melting Point: 213 °F (101 °C)

Refraction Index: 1.59427

Octanol/Water Partition Coefficient: log Kow = 4.57

Material Safety Data Sheet

From Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 624

NAPHTHALENE

Issued: November 1987

SECTION 1. MATERIAL IDENTIFICATION

24

Material Name: NAPHTHALENE

Description (Origin/Uses): Used as a moth repellant and in many industrial processes.

Other Designations: Naphthalin; Naphthene; Tar Camphor; $C_{10}H_8$;
NIOSH RTECS No. QJ0525000; CAS No. 0091-20-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the
Chemicalweek Buyer's Guide (Genium ref. 73) for a list of suppliers.

HMIS

H 2

F 2

R 0

PPG*

*See sect. 3

R 1

I 4

S 1

K 2



SECTION 2. INGREDIENTS AND HAZARDS

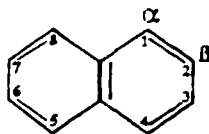
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EXPOSURE LIMITS

Naphthalene, CAS No. 0091-20-3

ca 100

IDLH* Level: 500 ppm



ACGIH TLVs, 1987-88

TLV-TWA: 10 ppm, 50 mg/m³

OSHA PEL

8-Hr TWA: 10 ppm, 50 mg/m³

Toxicity Data**

Child, Oral, LD₅₀: 100 mg/kg

Man, Unknown, LD₅₀: 74 mg/kg

Rat, Oral, LD₅₀: 1250 mg/kg

*Immediately dangerous to life and health

**See NIOSH RTECS for additional data with references to irritative, mutagenic, reproductive, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 424°F (218°C)

Vapor Density (Air = 1): 4.4

Vapor Pressure: 0.087 Torr at 77°F (25°C)

Water Solubility: Insoluble

Specific Gravity (H₂O = 1): 1.162 at 68°F (20°C)

Melting Point: 176°F (80°C)

Molecular Weight: 128 Grams/Mole

% Volatile by Volume: ca 100

Appearance and Odor: White crystalline flakes; strong coal tar odor.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

174°F (79°C) OC; 190°F (88°C) CC

979°F (526°C)

% by Volume

0.9

5.9

Extinguishing Media: Use water spray, dry chemical, or carbon dioxide to fight fires involving naphthalene. Caution: Foam or direct water spray applied to molten naphthalene may cause extensive foaming.

Unusual Fire or Explosion Hazards: Naphthalene is a volatile solid that gives off flammable vapor when heated (as in fire situations). This vapor is much denser than air and will collect in enclosed or low-lying areas like sumps. In these areas an explosive air-vapor mixture may form, and extra caution is required to prevent any ignition sources from starting an explosion or fire.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Naphthalene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Naphthalene is incompatible with strong oxidizing agents, chromic anhydride, and mixtures of aluminum trichloride and benzoyl chloride.

Conditions to Avoid: Ignition sources like open flame, unprotected heaters, excessive heat, lighted tobacco products, and electric sparks must not occur in work areas where naphthalene vapor may become concentrated.

Hazardous Products of Decomposition: Toxic gases like carbon monoxide are produced during fire conditions. Irritating, flammable vapor forms below the melting point because even solid naphthalene has a significant vapor pressure.

SECTION 6. HEALTH HAZARD INFORMATION

Naphthalene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Renal shutdown (kidney failure), hemolytic effects (breakdown of red blood cells), hematuria (blood in the urine), oliguria (low volume of urine), jaundice, eye damage, and depression of the central nervous system (CNS) are the primary health concerns associated with exposure to naphthalene. The ACGIH TLVs in section 2 are set to prevent eye damage. These recommended exposure limits may not be low enough to prevent blood changes in genetically hypersensitive individuals.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver, and kidneys. Administer medical exams emphasizing these organs. **Target Organs:** Eyes, skin, kidneys, liver, blood (red blood cell effects), and CNS.

Primary Entry: Inhalation, skin contact. **Acute Effects:** Inhalation of naphthalene vapor causes excitement, confusion, headache, nausea, and loss of appetite. **Chronic Effects:** Increased incidence of cataracts.

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes to remove particles.

Skin Contact: Immediately wash the affected area with soap and water.

Inhalation: Remove victim to fresh air; restore and/or support his breathing as needed.

Ingestion: Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Administer a gastric lavage followed by saline catharsis. Monitor blood and electrolytic balance. Other sources recommend giving the victim several glasses of water to drink.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all ignition sources immediately. Cleanup personnel need protection against contact and inhalation of vapor (see sect. 3). Contain large spills and collect waste. Use nonsparking tools to place naphthalene into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U165

CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. IDLH or unknown concentrations require an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.

Other Equipment: Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent skin contact. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems of sufficient power to maintain airborne levels of naphthalene below the OSHA PEL standard cited in section 2. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep this material off of your clothing and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store naphthalene in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).

Special Handling/Storage: Protect containers from physical damage. All bulk storage facilities must be built with an explosion-proof design. All containers used in shipping/transferring operations must be electrically grounded to prevent static sparks. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Comments: All operations with naphthalene must be done carefully to prevent accidental ignition of its flammable/explosive vapor. If the weather is warm, more naphthalene vapor forms and the potential for explosion increases. Do *not* smoke in any use or storage area!

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Naphthalene

DOT Hazard Class: ORM-A

IMO Class: 4.1

DOT ID No. UN1334

IMO Label: Flammable Solid

DOT Label: None

References: 1, 2, 12, 73, 84-94, 103. PJI

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Approvals

Indust. Hygiene/Safety

Medical Review



Section 1 - Chemical Product and Company Identification

43

Product/Chemical Name: Benzo(a)pyrene**Chemical Formula:** $C_{20}H_{12}$; a polynuclear aromatic hydrocarbon**CAS No.:** 50-32-8**Synonyms:** BaP; 3,4-benz(a)pyrene; BP; 3,4-benzopyrene; 3,4-benzpyrene. Formerly called 1,2-benzpyrene.**Derivation:** Synthesized from pyrene and succinic anhydride.**General Use:** Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires. **Vendors:** Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Benzo(a)pyrene, ca 100 %wt; except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals.

Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PELs

Coal tar pitch volatiles

8-hr TWA: 0.2 mg/m³**NIOSH REL**10-hr TWA: 0.1 mg/m³Carcinogen; coal tar pitch volatile,
cyclohexane extractable fraction.**IDLH Level**700 mg/m³Coal tar pitch volatiles (benzene soluble
fraction)**ACGIH TLVs**

A2: Suspected Human Carcinogen

DFG (Germany) MAK

None established

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Benzo(a)pyrene is a pale yellow, crystalline solid or powder that is irritating to the skin, eyes, and respiratory tract. It is a carcinogen and mutagen. Handle with extreme caution!

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion. **Target Organs:** Respiratory system, bladder, kidneys, skin.**Acute Effects:** **Inhalation:** Respiratory tract irritation. **Eye:** Irritation and/or burns on contact. **Skin:** Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization). **Ingestion:** None reported.**Carcinogenicity:** IARC, NTP, NIOSH, ACGIH, EPA, and MAK list benzo(a)pyrene as: an IARC 2A (probably carcinogenic to humans: limited human evidence, sufficient evidence in experimental animals), an NTP-2 (reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals), a NIOSH-X (carcinogen defined with no further categorization); an ACGIH TLV-A2 (suspected human carcinogen: carcinogenic in experimental animals, but available epidemiological studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans); an EPA-B2 (sufficient evidence from animal studies, inadequate evidence or no data from epidemiological studies); and an MAK-A1 (capable of inducing malignant tumors as shown by experience with humans) carcinogen, respectively.**Medical Conditions Aggravated by Long-Term Exposure:** Respiratory system, bladder, kidney, and skin disorders.**Chronic Effects:** **Inhalation:** Cough and bronchitis. **Eye:** Photosensitivity and irritation. **Skin:** Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization).**Other:** Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.**Comments:** Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polycyclic aromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).**Wilson
Risk
Scale**R 1
I 4
S 4
K 1**HMIS**H 2*
F 1
R 0* Chronic
Effects

PPE†

†Sec. 8

Section 4 - First Aid Measures

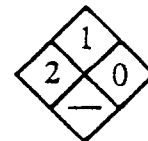
Inhalation: Remove exposed person to fresh air and support breathing as needed.

- Eye Contact:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.
- Skin Contact:** Quickly remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.
- Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.
- After first aid, get appropriate in-plant, paramedic, or community medical support.*
- Note to Physicians:** Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.
- Special Precautions/Procedures:** Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

- Flash Point:** None reported. Benzo(a)pyrene may burn, but does not readily ignite.
- Autoignition Temperature:** None reported.
- LEL:** None reported.
- JEL:** None reported.
- Extinguishing Media:** For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.
- Unusual Fire or Explosion Hazards:** None reported.
- Hazardous Combustion Products:** Carbon monoxide and carbon dioxide.
- Fire-Fighting Instructions:** Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways.
- Fire-Fighting Equipment:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

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Section 6 - Accidental Release Measures

- Spill /Leak Procedures:** Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.
- Small Spills:** Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.
- Large Spills**
- Containment:** For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways.
- Cleanup:** Do not dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. Do not reuse contaminated cleaning materials.
- Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

- Handling Precautions:** Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.
- Storage Requirements:** Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Section 8 - Exposure Controls / Personal Protection

- Engineering Controls:** Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet.
- Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly.**
- Ventilation:** Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)
- Administrative Controls:** Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV₁, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semi-

annual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure-demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Pale yellow monoclinic needles with a faint, aromatic odor.

Vapor Pressure: >1 mm Hg at 68 °F (20 °C)

Formula Weight: 252.30

Specific Gravity (H₂O=1, at 4 °C): 1.351

Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Boiling Point: >680 °F (>360 °C); 540 °F (310 °C) at 10 mm Hg

Melting Point: 354 °F (179 °C)

Octanol/Water Partition Coefficient: log Kow= 6.04

Section 10 - Stability and Reactivity

Stability: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Conditions to Avoid: Avoid heat and ignition sources and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11- Toxicological Information

Toxicity Data: *

Tumorigenic Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Mouse, inhalation: 200 ng/m³/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

Teratogenicity:

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Mouse, oral: 75 mg/kg administered to the female during the 12-14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Skin Effects:

Mouse: 14 µg caused mild irritation.

Mutagenicity:

Human, liver cell: 100 nmol/L caused DNA damage.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

* See NIOSH, RTECS (DJ3675000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

Environmental Transport: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp.*), snails (*Littornia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

Environmental Degradation: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr).

Soil Absorption/Mobility: It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Transportation Data (49 CFR 172.101):**

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*

Shipping Symbols: —

Hazard Class: 9

ID No.: UN3077

Packing Group: III

Label: Class 9

Special Provisions (172.102): 8, B54

Packaging Authorizations

a) Exceptions: 173.155

b) Non-bulk Packaging:

173.213

c) Bulk Packaging: 173.240

Quantity Limitations

a) Passenger, Aircraft, or Railcar: None

b) Cargo Aircraft Only: None

Vessel Stowage Requirements

a) Vessel Stowage: A

b) Other: —

* If it is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) of 1 lb (0.454 kg)

Section 15 - Regulatory Information**EPA Regulations:**

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

RCRA Hazardous Waste Number: U022

Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA and CWA, Sec. 307(a)

CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)

SARA 311/312 Codes: 1,2

SARA Toxic Chemical (40 CFR 372.65): Not listed

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

Listed as an OSHA Specifically Regulated Substance, Coal Tar Pitch Volatiles, (29CFR 1910.1002)

Section 16 - Other Information

References: 73, 103, 124, 127, 132, 133, 136, 139, 148, 164, 169, 174, 175, 184, 187, 189, 190

Prepared By: MJ Wurth, BS **Industrial Hygiene Review:** PA Roy, MPH **Medical Review:** T Thoburn, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 711
Pyrene

Issued: 4/90

Section 1. Material Identification

Pyrene Description: A condensed ring, polyaromatic hydrocarbon compound derived from coal tar. Also synthesized from o,o'-ditolyl. Used in biochemical research and as starting material for synthesizing benzo(a)pyrene. An ingredient of smoked and broiled meat, tobacco smoke, and air pollution.

Other Designations: CAS No. 9129-00-0; C₁₆H₁₀; beta-pyrene; benzo(d,e,f)phenanthrene; benzo(d,e,f)phenanthrene.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

R	1	Genium
I	3	
S	2*	
K	-	
* Skin absorption		
		HMIS
		H 2
		F 1
		R 0
		PPG†
		+ Sec. 3

Section 2. Ingredients and Occupational Exposure Limits

Pyrene, ca 100%

OSHA PEL

8-hr TWA: 0.2 mg/m³

ACGIH TLV, 1989-90

None established

NIOSH REL, 1987

None established

Toxicity Data*

Rat, oral, LD₅₀: 2700 mg/kg ingested produces conjunctiva irritation, excitement, and muscle contraction

Rat, inhalation, LC₅₀: 170 mg/m³ inhaled produces conjunctiva irritation, excitement, and muscle contraction

Gene mutation in mammalian cells; human cell types: 12 µmol/l

* See NIOSH, RTECS (UR2450000), for additional mutative, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 759 °F/404 °C

Melting Point: 313 °F/156 °C

Vapor Pressure: 6.85 x 10⁻⁷ torr at 68 °F/20 °C

Molecular Weight: 202.26 g/mol

Specific Gravity (H₂O = 1 at 39 °F/4 °C): 1.271 at 73 °F/23 °C

Water Solubility: Insoluble (0.135 mg/l)

Appearance and Odor: Colorless solid or a slight blue florescent solution. Tetracene impurities give pyrene a yellow color.

Section 4. Fire and Explosion Data

Flash Point: None reported

Autoignition Temperature: None reported

LEL: None reported

UEL: None reported

Extinguishing Media: Use foam, dry chemical, and CO₂ to extinguish fire.

Unusual Fire or Explosion Hazards: Pyrene is a flammable and combustible material that heat and ignition sources may ignite. It burns rapidly with a flare-like effect.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Avoid skin contact. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Pyrene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Hazardous Products of Decomposition: Thermal oxidative decomposition of pyrene can emit irritating fumes and acrid smoke.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists pyrene as a carcinogen.

Summary of Risks: Pyrene is irritating to exposed skin and eyes, moderately toxic by ingestion and intraperitoneal routes, and a poison by inhalation. Experimental studies show pyrene is a tumorigen in animals and a mutagen in humans. Workers exposed to concentrations between 3 and 5 mg/m³ showed some unspecified teratogenic effects. In general, human exposure occurs mainly through inhalation of tobacco smoke and polluted air. Although ingesting smoked and broiled meats may expose humans to pyrene, there is little indication of serious health effects.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Skin, eyes, respiratory tract.

Primary Entry Routes: Inhalation, ingestion, skin contact.

Acute Effects: Vapor inhalation may irritate the nose mucosa and respiratory tract. Vapors may also cause conjunctival irritation. Pyrene is absorbed through intact skin and causes dermal irritation. Ingestion may irritate and burn the esophagus and gastrointestinal tract.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of milk or water. Do not induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Observe patients with dermal exposure for systemic poisoning since pyrene is absorbed through intact skin.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, and remove all heat and ignition sources. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Scoop spilled material into appropriate disposal containers. Absorb liquid with inert, noncombustible material and place waste in appropriate disposal containers. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

RCRA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, Sec. 307(a)]

Listed as SARA Extremely Hazardous Substance (40 CFR 355), Reportable Quantity: 5000 lb, Threshold Planning Quantity (TPQ): 1000/10,000

SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

A Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or non-routine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2).

Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, well-ventilated area. Protect containers from physical damage.

Engineering Controls: Avoid vapor inhalation and skin contact. Practice good personal hygiene and housekeeping procedures. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Provide preplacement and periodic medical examinations, including comprehensive medical histories with emphasis on the oral cavity, respiratory tract, bladder, and kidneys. Examine the skin for premalignant and malignant lesions.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS for ACENAPHTHENEPage 1

1 - PRODUCT IDENTIFICATION

PRODUCT NAME: ACENAPHTHENE
FORMULA: C₁₀H₆-1,8-CH₂CH₂
FORMULA WT: 154.21
CAS NO.: 83-32-9
COMMON SYNONYMS: 1,2-DIHYDROACENAPHTHYLENE; 1,8-ETHYLENENAPHTHALENE
PRODUCT CODES: 4871
EFFECTIVE: 10/03/86
REVISION #02

PRECAUTIONARY LABELLING

PRECAUTIONARY LABEL STATEMENTS

WARNING
CAUSES IRRITATION

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN
THERE IS INSUFFICIENT DATA IN THE PUBLISHED LITERATURE TO ASSIGN COMPLETE
NUMERICAL SAF-T-DATA RATINGS AND LABORATORY PROTECTIVE EQUIPMENT FOR THIS
PRODUCT. SPECIAL PRECAUTIONS MUST BE USED IN STORAGE, USE AND HANDLING.
PROTECTIVE EQUIPMENT FOR LABORATORY BENCH USE SHOULD BE CHOSEN USING
PROFESSIONAL JUDGMENT BASED ON THE SIZE AND TYPE OF REACTION OR TEST TO BE
CONDUCTED AND THE AVAILABLE VENTILATION, WITH OVERRIDING CONSIDERATION TO
MINIMIZE CONTACT WITH THE CHEMICAL.
AVOID CONTACT WITH EYES, SKIN, CLOTHING.
KEEP IN TIGHTLY CLOSED CONTAINER. WASH THOROUGHLY AFTER HANDLING.

2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
ACENAPHTHENE	90-100	83-32-9

-----3 - PHYSICAL DATA

BOILING POINT:	279 C (534 F)	VAPOR PRESSURE(MM HG):	N/A
MELTING POINT:	95 C (203 F)	VAPOR DENSITY(AIR=1):	5.32
SPECIFIC GRAVITY:	1.02	EVAPORATION RATE:	N/A
(H ₂ O=1)		(BUTYL ACETATE=1)	
SOLUBILITY(H ₂ O):	NEGLEGIBLE (LESS THAN 0.1 %)	% VOLATILES BY VOLUME:	0
APPEARANCE & ODOR:	WHITE TO OFF-WHITE CRYSTALS.		

-----4 - FIRE AND EXPLOSION HAZARD DATA

MSDS for ACENAPHTHENEPage 2

FLASH POINT: N/A

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA

USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE

3 - HEALTH HAZARD DATA

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

DUST INHALATION MAY CAUSE TIGHTNESS AND PAIN IN CHEST, COUGHING, AND DIFFICULTY IN BREATHING.

CONTACT WITH SKIN OR EYES MAY CAUSE IRRITATION.

TARGET ORGANS

NONE IDENTIFIED

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

ROUTES OF ENTRY

INHALATION, SKIN CONTACT, EYE CONTACT, INGESTION

EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. FLUSH SKIN WITH WATER.

6 - REACTIVITY DATA

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: NONE DOCUMENTED

INCOMPATIBLES: STRONG OXIDIZING AGENTS

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE

7 - SPILL AND DISPOSAL PROCEDURES

MSDS for ACENAPHTHENE

Page 3

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.
WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND
COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
ENVIRONMENTAL REGULATIONS.

9 - PROTECTIVE EQUIPMENT

EYE/SKIN PROTECTION:

SINCE SOME OF THE HAZARDS OF THIS PRODUCT ARE
UNKNOWN, AN INDUSTRIAL HYGIENIST SHOULD BE
CONSULTED ON VENTILATION AND PERSONAL PROTECTIVE
EQUIPMENT. COVER THE BODY AS MUCH AS POSSIBLE TO
AVOID CONTACT WITH THE CHEMICAL. WEAR SAFETY
GOGGLES, GLOVES, AND IMPERVIOUS CLOTHING.

9 - STORAGE AND HANDLING PRECAUTIONS

SPECIAL PRECAUTIONS

KEEP CONTAINER TIGHTLY CLOSED. SUITABLE FOR ANY GENERAL CHEMICAL STORAGE
AREA.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	ACENAPHTHENE
HAZARD CLASS	ORM-E
LABELS	NONE
REPORTABLE QUANTITY	100 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	CHEMICALS, N.O.S. (NON-REGULATED)
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ATTACHMENT D

Confined Space Entry Supplement

1.0 INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) estimates that millions of workers may be exposed to hazards in confined spaces each year. The nature of a confined space increases the likelihood of encountering a toxic, flammable, or oxygen deficient atmosphere, because the confined space encourages accumulation of gases and vapors. While complete data is difficult to obtain, studies have suggested that as many as two-thirds of all confined space fatalities are potential rescuers. For every one worker fatality record, two additional fatalities occur during rescue attempts.

The main reason this occurs is that workers do not recognize the hazard presented by the confined space. Examples of confined spaces include storage tanks, process vessels, trenches, manholes, boilers, pits, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.

Specific standards for confined space entry have recently been finalized by the Occupational Safety and Health Administration (OSHA) under 29 CFR Part 1910.146. The final rule for Permit-Required Confined Space Entry was published in the Federal Register on January 14, 1993.

The following document provides safety procedures to be followed if entry into a confined space is necessary. It is assumed that no entry into a confined space is necessary; but if entry does become necessary, the provisions of this section shall be followed.

The confined space entry program is based upon a system which (1) identifies the permit space, (2) restricts the area so that only authorized personnel may enter, (3) controls the hazards through engineering or work practices, and (4) tests, monitors, or inspects the spaces to ensure that the hazards remain under control. For more information regarding general safety at the Site, consult the general Health and Safety Plan.

2.0 PROCEDURES FOR ENTRY INTO A CONFINED SPACE

2.1 Duties of Personnel Involved in Confined Space Entry

Prior to entry, each person involved should review and understand his or her respective responsibilities under the confined space entry program.

Attendant - Duties of the attendant include:

1. knowing the hazards that may be encountered during entry;
2. being aware of possible behavioral effects of hazardous exposure to authorized entrants;
3. continuously maintaining an accurate account of authorized entrants in the permit space and ensuring accurate identification of each authorized entrant;
4. remaining outside the permit space during entry operations until relieved by another attendant;
5. communicating with authorized entrants (two-way radios, if necessary);
6. monitoring activities inside and outside the space;
7. summoning rescue and other emergency services;
8. barring unauthorized persons from entering or approaching the permit space; and
9. performing non-entry rescues as specified by the rescue procedures.

The attendant's presence outside the permit space is vital even after an emergency has arisen. However, in an emergency situation, after an attendant is relieved by someone who assumes the attendant's required duties, the original attendant, if trained and equipped as required, can safely enter the permit space to begin a prescribed rescue attempt if non-entry rescue is not feasible.

Entry Supervisor - Duties of the entry supervisor include:

1. evaluating the conditions in and around any permit space that is to be entered;
2. overseeing entry operations, as necessary, to determine if the conditions are acceptable for entry;
3. where acceptable entry conditions are present, either authorizing entry to begin or allowing entry operations that are already underway to continue;
4. authorizing entry permits and canceling permits;
5. taking the necessary measures to protect personnel from permit space hazards; and
6. establishing respiratory protection levels based on initial and on-going atmospheric monitoring in the confined space.

Where acceptable entry conditions are not present, the entry supervisor either prohibits entry or, if entry is already underway, orders the authorized entrants out of the permit space and cancels the entry permit.

In situations where there are only a few employees, the entry supervisor may serve as an attendant or an authorized entrant as long as the entry supervisor is trained and equipped for each role he or she fills. All pertinent duties relating to the duties of attendants and authorized entrants would still apply to the entry supervisor who serves as an attendant or an authorized entrant.

2.2 Pre-Entry Procedures

The following procedures must be completed prior to initiating confined space entry.

2.2.1 Posting Signs

Where any confined space is considered a permit-required confined space, warning signs reading "Danger - Permit-Required Confined Space, Do Not Enter" or other similar language is required. However, if the only means of access necessitates the use of tools or keys, then the warning sign is

not required provided that the employees are trained to recognize the hazards involved.

2.2.2 Work Area Isolation

Isolating the confined space entry area requires banning smoking, open flames and other sources of ignition. Electrical and internal combustion equipment should be removed from the area and kept at a minimum distance of fifty feet in the upwind direction from the work area. If the electricity can be terminated outside the confined space, the electrical equipment (i.e. pump) does not need to be removed. If applicable, termination must be performed by removing fuses or de-energizing the circuit breaker at the breaker box and locking the box so that only the attendant can gain access. The fuses should be retained by the attendant. Additionally, an electrician experienced in such circuitry, should be consulted to assure that electricity cannot reach the confined space after it has been disconnected (i.e. possible surge from adjacent pumps).

Non-spark equipment shall be used at all times, unless a hot work permit has been issued. Equipment and appliances that may develop static electricity must be removed from the space to prevent inadvertent ignition of flammable gases or vapors. If doubt exists regarding a process and its potential for static electricity development, an electrician should be consulted. "Lockout" procedures for the confined space shall be used to secure machinery or moving parts that may be activated within the confined space.

The weather conditions and wind direction should be recorded on the confined space entry permit. During the entry, the attendant should stand up wind from the permit space.

2.2.3 Air Monitoring

Before an employee or contractor enters the space, the internal atmosphere shall be tested by trained personnel with a calibrated, direct-reading instrument specific to: oxygen, combustible gas (percent lower explosive limit (LEL)), and toxic air contaminants. When testing for atmospheric hazards, first test for oxygen, then for combustible gases and vapors, and lastly for toxic gases and vapors.

The determinations and supporting data for the decision regarding the status of the space (i.e., permit-required, non-permit required with ventilation, or non-permit required) must be documented by the employer on the top portion of the entry permit (presented at the end of this attachment) and made available to the entrants. Table E-1 lists the applicable action levels for air monitoring in confined spaces.

Atmospheric testing shall be performed in all areas of the confined space (i.e. top, center and bottom portions of the space) as some gases and vapors heavier than air shall accumulate towards the bottom of the confined space and others gases lighter than air shall be found near the top of the confined space. Testing shall be performed before and during entrance for toxic gases, asphyxiating conditions and flammable or explosive gases. Instruments should be calibrated according to the manufacturers' recommendations each day entries are scheduled.

When air monitoring needs to be performed in a confined space and the atmospheric conditions have not been determined, sampling devices equipped with extensions, hoses or other apparatus should be used so personnel do not have to enter the space. Furthermore, precautions should be taken near the area immediately adjacent to the confined space if the potential for exposure to toxic or explosive gases exists.

2.2.4 Preventing Physical Hazards

Workers within the confined space must be protected from external hazards. Barriers must be provided to protect entry personnel from outside hazards including pedestrian and vehicle traffic. Other physical hazards that may exist include:

1. Temperature extremes
2. Engulfment hazards, i.e. loose material collapsing
3. Noise
4. Slick wet surfaces

5. Falling objects
6. Slips, trips, and falls
7. Electrical hazards

The entrant shall wear a minimum of modified Level D protection with a hard hat, chemical resistant gloves, chemical resistant safety boots/shoes, splash goggles, and disposable chemical resistant clothing as necessary. Personal protective equipment is described in more detail in the Health and Safety Plan.

2.3 Confined Space Entry Permit

The permit system serves as a checklist and documentation that proper non-permit and permit-required confined space entry determinations were made and that safety procedures were implemented by trained personnel. The permit system is the responsibility of the Health and Safety Coordinator (HSC), the Site Health and Safety Officer (SHSO) and all other trained personnel.

The entry supervisor shall sign or initial the permit before the entry begins, but not until all actions and conditions necessary for safe entry into the permit space have been performed. The permit shall be made readily available to all entrants during the operation. The standard suggests posting the permit near the confined space. Upon completion of the entry covered by the permit, and after all entrants have exited the permit space, the entry supervisor shall cancel the permit after proper closure of the confined space or if a situation arises which is prohibited under the entry permit. The canceled permit shall be retained for a period of at least one year.

The permit must be filled out completely for permit-required confined spaces and is only valid for the date issued. For non-permit spaces, the top portion of the entry permit must be completed along with results of verification atmospheric sampling.

The following information must be included on the permit:

1. Identification of the permit space to be entered;
2. Purpose of entry;
3. Date of entry and the authorized duration of the entry permit;
4. List of authorized entrants within the permit space;
5. List of attendants currently serving the permit space;
6. Name of the individual currently serving as entry supervisor;
7. The signature, together with the name printed or otherwise legible, of the entry supervisor who originally authorized entry;
8. The hazards of the permit space to be entered;
9. The measure used to isolate the permit space and to eliminate or control permit space hazards before entry;
10. The acceptable entry conditions;
11. The results of initial and periodic tests performed, accompanied by the names or initials of the testers and by an indication of when the tests were performed;
12. The rescue and emergency services that can be summoned and the means for summoning them;
13. The communication procedures used by authorized entrants and attendants to maintain contact during the entry;
14. Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance;
15. Any other information which is necessary, given the circumstances of the particular confined space, to ensure employee safety;

16. Any additional permits, such as for hot work, that have been issued to authorize work in the permit space; and
17. Employers who intend to authorize hot work in a permit space, such as welding, shall note that intention prominently on either the entry permit or on a separate hot work permit which is attached to the permit.

2.4 Confined Space Entry

Prior to entry into any confined space, the authorized entrant must notify emergency standby personnel of the entry by completing a radio check. A radio check must also be completed following the entry.

Confined spaces may be entered without a written permit or attendant provided that: 1) the space is determined not to be a permit-required confined space, or 2) the space can be maintained in a safe condition for entry by mechanical ventilation alone.

All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Refer to the end of this attachment, for definitions of permit-required confined spaces and non-permit confined spaces.

Prior to any entry, the space should be "aired-out" or ventilated. Ventilation procedures are as follows:

1. After removing the entrance cover, the opening shall be guarded by a temporary barrier that shall prevent an accidental fall through the opening and that shall protect each employee working in the space from foreign objects entering the space.
2. Ventilate each confined space by removing the cover and allowing it to "air out" for at least fifteen minutes.
3. Test the space for oxygen deficiency, combustible gas (e.g., methane) and toxic gases or vapor (e.g., hydrogen sulfide), with a multiple gas detector and other appropriate equipment.

2.4.1 Non-Permit Spaces

Non-permit spaces were not defined in the proposed confined space standard but have been added to the final rule to allow greater flexibility to facilities with low-hazard situations.

If it is determined that no hazardous atmosphere exists, continuous forced-air ventilation shall not be required prior to entry. However, if it is determined that a hazardous atmosphere does exist but can be adequately controlled by the use of forced air ventilation, the employer must follow the following procedures for ventilation in a non-permit space as described below.

Continuous forced air may be used as follows:

1. A worker (including contractors) may not enter the space until the forced air ventilation has eliminated the hazardous atmosphere;
2. The confined space should be ventilated with a ventilating fan and trunk hose. One end of the hose shall be attached to the fan and the other end shall be lowered into the confined space. Ventilation should be continuous.
3. The air supply for the forced air ventilation shall be from a clean, upwind source and may not increase the hazards in the space (e.g., diesel powered generators may introduce carbon monoxide into the space);
4. The forced air ventilation shall be so directed to ventilate the immediate areas where a worker is or shall be present within the space and shall continue until all employees have left the space; and
5. The atmosphere within the space shall be periodically tested with the fan running to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere.

When there are changes in the use or configuration of a non-permit required space that might increase the hazards to the entrants, the employer shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

If a hazardous atmosphere develops despite the use of forced air ventilation, the following procedures shall be followed:

1. Each employee shall leave the space immediately;
2. The space shall be evaluated to determine how the hazardous atmosphere developed; and
3. Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

If it is determined that a hazardous atmosphere cannot be controlled by the use of forced air ventilation, the confined space shall be reclassified as a permit-required confined space and shall be subject to the following requirements for permit-required confined space entry.

2.4.2 Permit-Required Confined Spaces

If it is determined that a permit-required confined space exists, employees shall be notified of the confined space via a sign which reads "**DANGER - PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER**" or other similar language.

A half-face or full-face air purifying respirator as appropriate should be worn at all times by the authorized entrant if levels of toxic substances are present above the respective permissible exposure limit (PEL), threshold limit value (TLV) or other action level assigned by the SHSO. If an oxygen deficiency is present or if a toxic atmosphere exists that is immediately dangerous to life and health (IDLH) despite the use of forced air as described in Section 2.4.1, a self-contained breathing apparatus (SCBA) or supplied air respirator (SAR) must be worn by the authorized entrant.

2.4.3 Retrieval Systems

Retrieval systems or methods must be used whenever an authorized entrant enters a permit-required confined space, unless the equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.

Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, or above the entrant's head. Wristlets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard, and that the use of wristlets is the safest and most effective alternative.

In spaces with a vertical depth greater than five feet, the other end of the retrieval line shall be attached to a mechanical device (e.g., tripod with winch) outside the permit space so that the rescue can begin as soon as the rescuer becomes aware that rescue is necessary. In all other permit-required confined spaces, the retrieval lines must be attached to a mechanical device or a fixed point outside the permit space.

2.5 Contractor Requirements for Confined Space Entry

If a contractor is ever required to enter a permit-required confined space located at the Site, the contractors must be apprised of and comply with the following procedures:

1. Inform the contractor that the work place contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting requirements of the standard;
2. Apprise the contractor of any precautions or procedures that the host employer has implemented to protect employees in or near permit spaces where contractor personnel shall be working;
3. Apprise the contractor of the elements, including the hazards identified and the host employer's experience with the space, which make the space in question a permit space;

4. Coordinate entry operations with the contractor when both host employer personnel and contractor personnel shall be working in or near permit spaces; and
5. Debrief the contractor at the conclusion of the entry operations regarding the permit space program followed and any hazards confronted or created in permit spaces during entry.

The contractor shall:

1. Enter the permit-required confined space only after completing of atmospheric testing;
2. Obtain any available information regarding permit space hazards and entry operations from the host employer;
3. Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel shall be working in or near permit spaces; and
4. Inform the host employer of the permit space program that the contractor shall follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.

3.0 PERSONNEL TRAINING REQUIREMENTS

Confined space entry training procedures are required for all employees involved in the confined space program. Training shall be provided for employees to acquire the understanding, knowledge, and skills necessary to safely perform the duties assigned and shall introduce new or revised procedures, as necessary, for compliance. Training shall be provided to each affected employee:

1. Before the employee is first assigned confined space entry duties;
2. Before there is a change in assigned duties;
3. Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;
4. Whenever the employer has reason to believe that there are deviations from the permit space entry procedures specified in this plan or that there are inadequacies in the employee's knowledge or use of these procedures.

At a minimum, the employee must have a working knowledge of the following:

1. Hazard recognition;
2. Operating testing and monitoring equipment to verify that acceptable environmental conditions are being maintained during entry;
3. Maintenance of monitoring equipment;
4. Personal protective equipment, respirators, clothing and retrieval lines, etc.;
5. Rescue services to be summoned;
6. Rescue equipment provided on Site, (e.g. safety harnesses, tripod, winch, first aid kit, ventilation equipment, fire extinguisher, stretcher, water, container to hold contaminated materials, additional personal protective equipment);
7. Communications procedures and equipment; and
8. Any other site-specifics information given in the entry permit to insure employee safety.

The HSC is required to certify that the training has been accomplished. The certificate should include each employee's name, the signature or initials of the trainers, and the dates of training. The certificate of training is contained in this attachment and shall be maintained for the duration of employment.

4.0 HOT WORK PROCEDURES

4.1 General

As per 29 CFR 1910.119(k), a hot work permit must be issued for hot work operations conducted in or near a covered area such as a confined space. Hot work is defined as work involving the use of electric or gas welding, cutting, brazing, or similar flame or spark-producing operations. The permit shall document that fire prevention and protection requirements (as specified in 29CFR 1910.252(a)) have been undertaken prior to beginning the hot work operations. The permit must indicate the date(s) authorized for hot work and identify the object on which the work is to be performed. The permit must be kept on file until completion of the hot work operations.

The hot work permit acts exclusively as an addendum to the confined space entry permit and does not serve as the confined space entry permit while "hot work" is being performed. In other words, when hot work is being performed inside a confined space, the confined space entry permit must be completed with the hot work permit attached. The hot work permit is valid only for the date(s) issued.

Part 1910.252(a) of Title 29 specifies general fire prevention and protection requirements necessary during welding, cutting and brazing operations. Below are specific safety practices which must be adhered to:

1. If the object to be welded or cut cannot readily be moved, all movable fire hazards in the vicinity must be taken to a safe place. If the object cannot be moved and fire hazards cannot be removed, then guards shall be used to confine heat and sparks and to protect the immovable fire hazards.
2. Suitable fire extinguishing equipment must be maintained and ready for use. Such equipment may consist of pails of water or sand or portable extinguishers.

3. Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing the operations. The person shall designate precautions to be followed in granting authorization to proceed in the form of the written hot work permit.
4. When arc welding is to be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so that accidental contact cannot occur. The machine shall be disconnected from the power source.
5. To minimize the possibility of gas escaping through leaks or improperly closed valves when gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively shut off at some point outside the confined area whenever the torch shall not be used for a substantial period of time. Where practicable, the torch and hose should be removed from the confined space.

4.2 Management Responsibilities

It is the responsibility of management to advise all contractors about flammable materials or hazardous conditions as related to performing hot work. The SHSO shall be responsible for the overall administration of the hot work permit program. They shall ensure that work areas have been properly prepared for the hot work and that the hot work permit has been properly completed.

5.0 RESCUE AND EMERGENCY SERVICES

Confined space entry rescues at the Site shall employ the use of trained employees to enter permit spaces to perform rescue services in the event of a confined space entry emergency. The designated rescue team shall be informed of the hazards that may be confronted when asked to perform a rescue at the facility. Access must be provided to all permit spaces.

If an injured entrant is exposed to a substance noted on the required material safety data sheet kept at the work Site, that MSDS shall be made available to the medical facility treating the exposed entrant. The following training requirements apply to employees who are members of the on-site rescue service:

1. Each member of the rescue team must be provided with, and trained in the proper use of personal protective equipment and rescue equipment necessary for making rescues from permit spaces.
2. Each member of the rescue team must be trained to perform the assigned rescue duties and receive the training required of employees involved in the confined space entry.
3. Members of the rescue team shall practice making permit space rescues at least once every twelve months, by simulating rescue operations in which dummies, manikins, or actual persons are removed from the permit spaces or from representative permit spaces. Representative permit spaces shall simulate the types of permit spaces from which rescue is to be performed, with respect to opening size, configuration, and accessibility.
4. Training shall include basic first-aid and cardiopulmonary resuscitation (CPR). At least one member of the rescue team holding current certification in first aid and in CPR shall be available.

Members of the rescue team shall enter the confined space only if a non-entry rescue is infeasible and atmospheric hazards do not exist. To facilitate a non-entry rescue, retrieval systems or methods complying with the retrieval systems for confined space entry procedures (Section 2.4) shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.

6.0 APPLICABLE DEFINITIONS

Attendant: Individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program. Attendants may be assigned to monitor more than one space and may be stationed at any location outside the permit space, as long as they can effectively perform the duties defined in the permit space program. The attendants may not monitor more permit space entry operations than they can safely handle.

Authorized Entrant: Employee who is authorized by the employer to enter a permit space.

Confined Space: is a space that:

1. is large enough and so configured that an employee can bodily enter and perform assigned work; and
2. has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and
3. is not designed for continuous employee occupancy.

Entry: the action by which a person passes through an opening into a permit-required confined space (PRCS). Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry Supervisor: The person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, overseeing entry operations to determine if the conditions are acceptable for entry, authorizing entry to begin, authorizing entry permits and canceling permits, and taking the necessary measures to protect personnel from permit space hazards.

Hazardous Atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, serious injury or acute illness due to:

1. A flammable gas, vapor, or mist in excess of ten percent of its lower explosive limit (LEL);
2. An airborne combustible dust at a concentration that exceeds its lower explosive limit (LEL);

3. An atmospheric oxygen concentration that is less than 19.5 percent or greater than 23.5 percent;
4. An atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G or Subpart Z of 29CFR 1910 and that could result in employee exposure above the pertinent dose limit or permissible exposure limit; and
5. Any other atmospheric condition recognized as immediately dangerous to life or health.

Non-Permit Confined Space: a confined space that does not contain or, with respect to atmosphere hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Permit-Required Confined Space (PRCS): a confined space that has one or more of the following characteristics:

1. Contains (as obtained by a field air screening instrument) or has a potential to contain a hazardous atmosphere;
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration so that an entrant could be trapped or asphyxiated by inwardly converging walls or a floor which slopes downward and tapers to a smaller cross-section; and/or,
4. Contains any other recognized serious safety or health hazard.

Permit-Required Confined Space Program: The overall program for controlling, and, where appropriate, for protecting employees from permit space hazards and for regulating employee entry into permit spaces.

HOT WORK PERMIT

Effective permit dates: _____

Persons authorized to perform work: _____

Description and location of work to be performed: _____

"Hot" equipment to be used (e.g. welding, cutting torches, etc.): _____

Additional safety procedures to be followed: _____

Health and Safety Coordinator

Health and Safety Officer

* This permit is valid only for the date(s) issued and must be accompanied with a valid Confined Space Entry Permit.

CONFINED SPACE ENTRY PERMIT

All copies of permit shall remain at job Site until job is completed. This permit is only valid for date issued.

LOCATION and DESCRIPTION
of CONFINED SPACE _____

Date _____

PURPOSE of Entry _____

Time _____

RESCUE TEAM MEMBERS _____

ENTRY SUPERVISOR _____

WEATHER CONDITIONS _____

WIND DIRECTION _____

DETERMINE TYPE OF CONFINED SPACE

Does confined space have potential to contain one or more of the following (check those that apply):

___ a hazardous atmosphere (a hazardous atmosphere is defined as any atmosphere where the action levels are exceeded for the measured contaminants)

___ Document verification testing results in table below.
___ a material that has potential for engulfing an entrant

___ an internal configuration that may cause trapping or asphyxiation

___ other serious safety or health hazards (please specify)

☐ Permit-required confined space

☐ Non-permit space

If confined space contains one of the aforementioned criteria, the confined space shall be deemed a permit-required confined space.

LIST OF AUTHORIZED ENTRANTS

SPECIAL REQUIREMENTS	YES	NO		YES	NO
Lock Out - De-energize - Shutdown Open Flames			Escape Harness/Lifelines/Retrieval System		
Lines Broken - Capped or Blanked			Safety Manual		
Purge - Flush and Vent			Communications Equipment (RADIOS, etc.)		
Ventilation Equipment (fan & hose)			Fire Extinguishers		
Secure Area/Rope Off/Post NO SMOKING Signs			Lighting		
Breathing Apparatus/SCBA/Respirator			Protective Clothing/Boots/Gloves/Splash Goggles		
Combustible Gas Indicator, Photoionization Detector, H ₂ S-CO Meter, Oxygen Detector			other (list on back)		

Sheet 1 of 2

CONFINED SPACE ENTRY PERMIT

TEST(S) TO BE TAKEN *(valid for one 2-hour turn only)	ACTION LEVEL	TEST LOCATIONS/RESULTS				
% of Oxygen	≤19.5% or ≥23.5%					
% of Lower Explosive Limit (LEL)	≥10%					
Hydrogen Sulfide	≥5 ppm					
Carbon Monoxide (CO)	≥30 ppm					
other (list)	Varies					

ATMOSPHERE TESTER _____
NAME (please print)

Note: Continuous/periodic testing regimen shall be established before beginning job.
Any questions pertaining to test requirements contact the Project Manager.

INSTRUMENTS USED	NAME	TYPE	MODEL & SERIAL NO.

SUPERVISOR AUTHORIZING ALL ABOVE CONDITIONS SATISFIED (Entry Supervisor)
SIGNATURE _____ DATE _____

AMBULANCE _____ FIRE _____
Sheet 2 of 2

CONFINED SPACE ENTRY PROGRAM

TABLE E-1

Action Levels

MONITORING EQUIPMENT	MEASURED LEVEL	ACTION
Explosive/Combustible Meter ^a	0-10% LEL	Continue work
	>10% LEL	Cease all operations, leave space, and contact SHSO. Potential explosive hazard
Oxygen Meter	< 19.5%	Cease all operations, leave space, and contact SHSO
	19.5% - 23.5%	Continue work. Deviation from normal level may be due to the presence of other substances
	>23.5	Cease all operations, leave space, and contact SHSO. Potential fire hazard
H ₂ S Meter ^b	0-5 ppm	Continue on-site monitoring with extreme caution as higher levels are encountered
	>5 ppm	Cease all operations, leave space, and contact SHSO. Potential health hazard

- a. - Combustible gas readings are not valid in atmosphere with < 19.5 percent oxygen.
- b. - Note: Negative pressure respirators are not approved for, or recommended for protection against H₂S.

ATTACHMENT E
Trenching and Excavation Supplement

TRENCHING AND EXCAVATION SUPPLEMENT

This document covers the provisions set forth in the federal OSHA Excavation Standard, 29 CFR Part 1926.650-653, Subpart P. The standard establishes safety procedures and engineering controls to be followed when entry into trenches and excavations is necessary. This Trenching and Excavation Supplement provides a general outline of the procedures to be used when working in excavations, and to the applicable OSHA trenching and excavation references. This document is neither all inclusive nor is it intended to replace federal and state OSHA guidelines.

According to the OSHA standard, a trench is referred to as a narrow excavation below the surface of the ground. In general, the depth is greater than the width, but the width (measured at the bottom) is not greater than fifteen feet. An excavation is any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal.

Site personnel shall be trained to recognize hazards associated with trenches and excavations, such as cave-ins, hazardous atmospheres, surface encumbrances, traffic conditions, water accumulation, and underground utilities. Site personnel shall become familiar with the work practices and engineering controls necessary to mitigate such hazards.

Personnel working at the Site shall not be permitted to enter trenches or excavations unless it is deemed inherently necessary. If entrance is necessary, the SHSO or HSC shall be notified prior to entering.

It is important to establish standard operating procedures for all employees who are either directly involved with performing excavation work or who are required to inspect such work, must follow. Some of the procedures to be followed are identified below.

1.0 Utilities

All surface obstacles, such as telephone poles, fire hydrants, buildings, fences, vehicles, etc. shall be removed or supported. Where the potential exists or encountering underground utilities, the following procedures shall be implemented:

1. estimate the location of utility installations prior to beginning the work;
2. contact utility companies to advise them of the proposed work and to establish underground utility locations prior to beginning work; and
3. protect, support, or remove underground pipelines, cables, or other installations as necessary.

1.1 Access and Egress

Ramps may be used if designed by a qualified, competent person. Ramps with two or more members must have the members connected. All connecting cleats must be attached to the bottom of the ramp and in a manner to prevent tripping hazards. All members must be of uniform thickness and all ramp surfaces shall consist of non-slip surfaces. A means of access and egress (ladders, ramps, etc.) for all trenches four feet or over in depth shall be required and located not more than twenty-five feet from where employees are working.

1.2 Heavy Equipment

All personnel exposed to vehicular traffic in the vicinity of the excavation area shall wear warning vests made of bright orange reflective material. No personnel may be permitted underneath loads or objects capable of falling. Operators of mobile equipment must have a clear view while working near the excavation or have other warning devices such as barricades, hand mechanical signal devices, or stop blocks. Heavy equipment must stop at least two feet from the side of any excavation. If possible, the grade should be away from the excavation.

1.3 Air Monitoring

Atmospheric monitoring is required under the following conditions if:

1. atmospheric conditions could potentially be below 19.5 percent oxygen by volume;
2. a potentially explosive atmosphere may exist in the excavation (i.e., >10% LEL);
3. atmospheric conditions present the potential for the presence of toxic gases and vapors in the excavation; and
4. it is known that little or no natural ventilation can occur in the excavation.

Entrance shall not be permitted if it is deemed that a hazardous atmosphere does exist until the Health and Safety Coordinator (HSC) has been consulted and the proper provisions have been established.

1.4 Water Accumulation

Personnel shall not be allowed entry into excavations containing water or inexcavation where water has accumulated unless water can be removed from the excavation. Procedures under these circumstances include, but are not limited to:

1. use of special precautions such as special shoring, pumps, or a lifeline and harness;
2. presence of a competent person to monitor conditions in the excavation; and
3. when natural drainage is interrupted, a dike, diversion ditch or other means shall be used to prevent runoff from entering into or accumulating in an adjacent area; and
4. no electrical devices shall be permitted inside excavations until all water has been removed.

1.5 Adjacent Structures

When affected by the excavation, adjacent structures shall be adequately supported by shoring, bracing, or underpinning to ensure stability. Excavating below footings of foundation shall not be permitted unless the following conditions are met:

1. a support system is used;
2. the excavation is in stable rock; or
3. a professional engineer deems it to be stable.

Streets, sidewalks or other structures shall not be undermined by the excavation, unless adequate support systems are used.

1.6 Protection from loose rock or soil

Precautions, such as removing loose material, installing protective barricades, etc., shall be taken to protect employees from loose rock and soil falling or rolling from the excavation face. Excavated materials, equipment, and tools shall be set back at least two feet from excavation walls or guarded from falling into excavations.

1.7 Inspections

A competent person must inspect the excavations, adjacent areas, and protective systems daily prior to each shift and throughout the shift to ensure that hazardous conditions or a hazardous atmosphere does not exist. All personnel shall be kept away from hazardous areas until hazards have been eliminated, controlled, or corrected. Inspections shall be made after every rainstorm or other hazardous occurrence.

1.8 Fall protection

Hand rails or guards shall be provided where personnel or equipment are permitted to cross over excavations on walkways or bridges. Barriers shall be provided when an excavation is left unattended unless access cannot be gained to the excavated area.

1.9 Sloping and Benching Design

Sloping and benching design shall be selected by the Project Coordinator or his or her designee and must follow requirements set forth in 29 CFR 1926, Subpart P. Specific requirements are established in 29 CFR 1926.652(b) and (c), and Subpart P, Appendix A, B, C, D, E, and F which include:

1. Subpart P, Appendix A details the procedures to be used to classify soil;
2. Subpart P, Appendix B defines the sloping and benching systems to be used, based on soil type and excavation configuration;
3. Subpart P, Appendix C specifies minimum timber shoring requirements for trenches according to soil type and excavation configuration;
4. Subpart P, Appendix D specifies aluminum hydraulic shoring for trenches according to soil type and excavation configuration;
5. Subpart P, Appendix E provides alternatives to Timber Shoring; and
6. Subpart P, Appendix F contains a decision chart for the selection of protective systems.

1.10 Protective Systems

The following procedures shall be implemented as applicable for trench boxes, aluminum hydraulic shoring systems, timber shoring systems, etc.:

1. all members of the system shall be securely connected to prevent failure;
2. the system shall be installed and removed in a manner as to protect personnel from cave-ins;
3. support members shall not be subjected to forces greater than their design strength as reported by the manufacturer;
4. removal shall begin from bottom to top, release shall occur slowly, and temporary members shall be installed to protect personnel working in the trench;
5. backfill shall progress along with the moving or removal of a protective system;

6. excavation depth may not exceed more than two feet past the bottom of the system;
and
7. personnel shall not be permitted in the excavation during installation, removal, or replacement of the protective system.

The OSHA Excavation Standard requires that a "competent person" be designated to make judgments regarding the use of sloping and benching techniques. The competent person shall be an individual capable of identifying existing and predictable hazards in the work area which pose potential physical danger to employees. He/she has the authorization to take prompt corrective actions to mitigate any potential hazards.

Site personnel shall follow the instructions of the competent person and the set requirements as detailed in 29 CFR 1926, Subpart P. Additional OSHA Standards for hazardous energy control (lockout/tagout), personnel protective equipment, confined space entry, and hazard communication may apply to work scenarios involving excavation and should be referenced and followed as appropriate.

1.11 Training Requirements

Initial training of affected site personnel shall include an overview of the OSHA Excavation Standard and a detailed review of required sloping, benching, and protective system uses and techniques as they apply to typical soil stability conditions at the Site.

Refresher training shall be required when the standard is revised and when new sloping, benching, and protective system techniques are instituted.

1.12 Definitions

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-In means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent Person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross Braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Hazardous Atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with this standard. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable Rock means natural solid mineral material that can be excavated with vertical sides and shall remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured againstcavin-ins or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Support System means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Uprights mean the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed sothat individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales mean horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

ATTACHMENT F

Energy Control (Lockout & Tagout)

HAZARDOUS ENERGY CONTROL PROGRAM

(LOCKOUT/TAGOUT)

The Occupational Safety and Health Administration (OSHA) has an existing standard, 29 CFR 1910.147, governing the control of hazardous energy sources (lockout/tagout) in workplaces. The standard covers servicing and maintenance (including installation and removal) of machines and equipment in which the unexpected energizing or start up of the machines and equipment or release of stored energy could cause injury to employees. The rule requires that energy sources for the equipment be turned off or disconnected prior to performing work and that the switch either be locked or at the very least be labeled with a warning tag or both depending on circumstances.

Industrial personnel and contractors who perform service on such machines and equipment face the greatest risk. These include craft personnel, maintenance personnel, machine operators and laborers. At this Site, employees shall be working around, installing, fixing, or removing devices like pumps, fans, electrical apparatus, controls, etc. Typical injuries associated with the non-existence or improper use of a lockout/tagout system could include fractures, lacerations, electrocutions, contusions, amputations, and puncture wounds. At this Site, we shall utilize a program to comply with OSHA requirements and must insist that all employees and contractors comply with these rules as a minimum.

PROGRAM REQUIREMENTS

1. Prior to work, contractors shall mark machines and their disconnecting means so that appropriate switch gear can be quickly located. If markings become unreadable, please report it to your supervisor.
2. Employees must use key locks on devices, machine control boxes or on electrical circuit breaker boxes when maintenance, repair, installation or removal is being performed.

3. Ensure that new equipment or overhauled equipment can accommodate locks. Retrofit equipment to accept locks where feasible. Locking is the preferred method of control.
4. Employees must implement additional means as necessary to ensure safety whentags rather than locks are used by implementing an effective tagout program. Tag devices shall be constructed and printed so that exposure to moisture and corrosive chemicals shall not cause deterioration and render them unreadable (see sample tags attached). Tagout device attachment means shall be non-reusable, attachable by hand, self-locking and non-releasable with a minimum unlocking strength of no less than fifty pounds and having the general design and characteristics equivalent to a one-piece, all environment-tolerant nylon cable tie. Tagout devices shall warn against hazardous conditions if the machine is energized and shall include a legend such as: **DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, DO NOT OPERATE**. Tagout devices are readily available for purchase through safety supply catalogs. Nylon ties are available at most industrial supply outlets.
5. Lockout and tagout devices should be standardized throughout the project utilizing the following criteria as applicable: color, shape, size, and in the case of tagout devices, print and format.
6. The project HSO shall conduct regular inspections of energy control procedures as deemed necessary to assure proper use of the program. The inspection shall be designed to correct any deviations or inadequacies observed.
7. If another crew or person continues to work on the maintenance installation, removal or repair job during the next shift, the relief personnel shall put his or her lock on before the initial personnel removes his or her lock.
8. Minor adjustment and servicing activities, which might take place during normal operations, shall not require lockout/tagout procedures to be employed if they are routine, repetitive, and integral to the use of the equipment for production, but other standard OSHA safeguarding procedures or mechanisms (e.g., guards) must be utilized.
9. Before lockouts or tagouts are removed and energy is restored to the equipment or machine, the following procedures shall be followed: 1) the work area shall be inspected to ensure that non-essential items have been removed and machine components are operationally intact; 2) the work area shall be checked to ensure that all employees are safely positioned or removed; and 3) affected employees shall be notified that lockout/tagout devices have been removed.
10. Each lockout/tagout device shall be removed only by the employee who applied the device. If that employee is not available to remove it, the device may be removed under the direction of the HSC, SHSO, or Project Coordinator, but only after it has been verified that the authorized employee is not at the facility.

11. Under no circumstances should locks or keys be loaned or borrowed. Lost keys shall be reported immediately and duplicates destroyed.

ATTACHMENT G

Emergency Telephone Numbers and Map to the Hospital

EMERGENCY TELEPHONE NUMBERS

Site Name and Number Toledo Tie Treatment Superfund Site PWM001

GENERAL

PHONE

U.S. EPA 24-Hour Hotline (National Response Center)
CHEMTREC (Chemical Information)

1-800-424-8802
1-800-424-9300

LOCAL

Ambulance
Fire

419/693-1611
419/729-4811

Police
Hospital
* 911 services available

419/243-4141
419/381-3888

Kerr-McGee Chemical, LLC
Project Coordinator: Peter Goetz

Office 405/447-8300
Pager 888/732-8904
Mobile 405/833-9009

HULL & ASSOCIATES, INC.
Project Manager: Scott F. Lockhart, P.E.

Office 419/241-7171
Pager 419/323-1396
Mobile 419/262-9318

Health and Safety Coordinator: Gary D. Lescallett

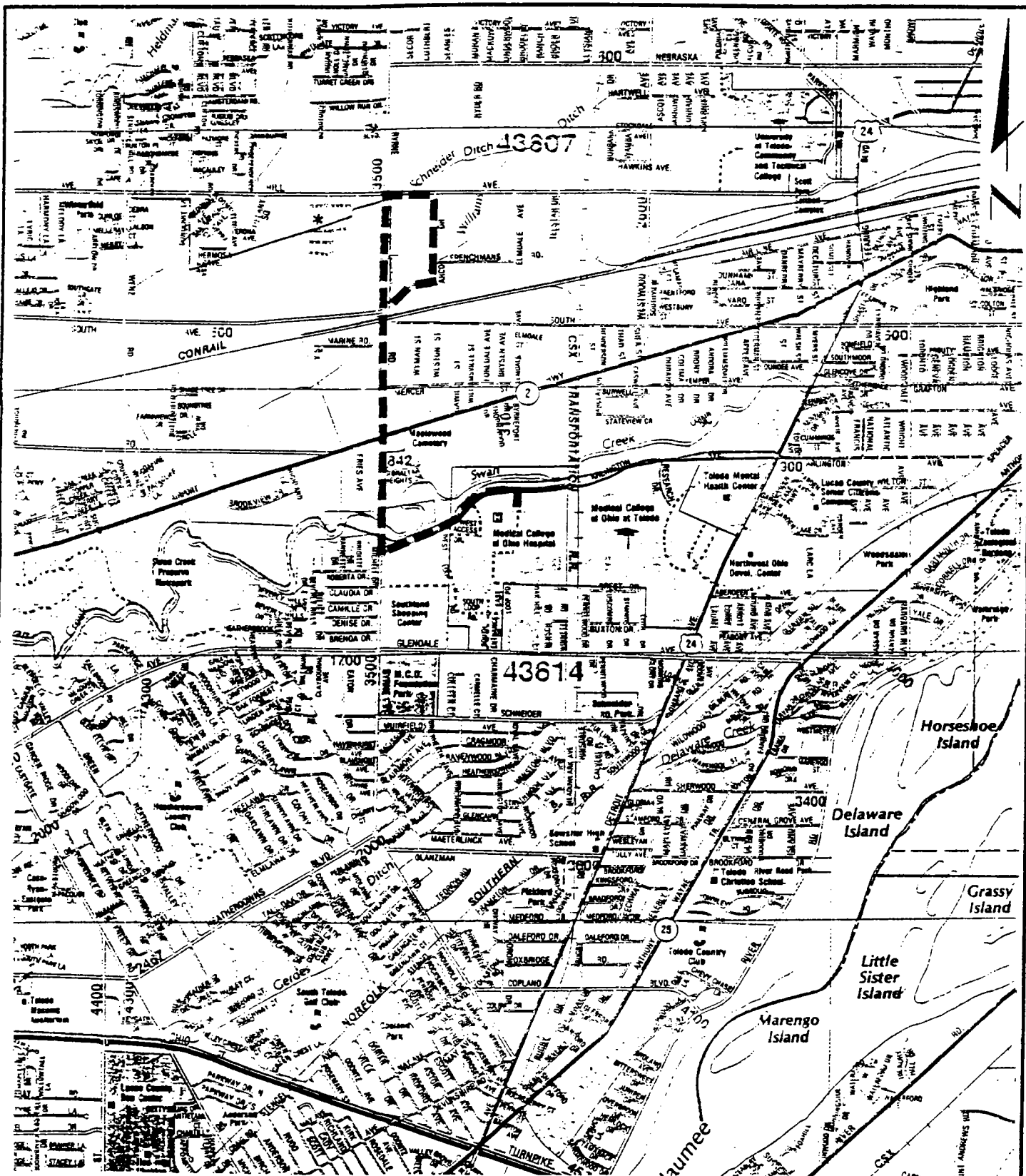
Office 419/241-7171
Mobile 419/270-8016

Health and Safety Officer: _____

Office 419/241-7171
Mobile _____

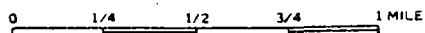
HOSPITAL DIRECTIONS

Name of Hospital: Medical College Hospital
Route to Hospital: See Attached Map



LEGEND

ROUTE TO HOSPITAL



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ATTACHMENT G

Hull & Associates, Inc.
TOLEDO, OHIO

HEALTH & SAFETY PLAN
KERR-McGEE CHEMICALS, LLC
TOLEDO TIE TREATMENT SUPERFUND SITE
ROUTE TO HOSPITAL MAP
CITY OF TOLEDO, LUCAS CO., OHIO

DATE:
FEBRUARY 1998

PMW001

ATTACHMENT H

Injury/Illness Investigation



Hull & Associates, Inc.
2726 Monroe Street
Toledo, Ohio 43606
Telephone (419) 241-7171
Fax (419) 241-3117

INJURY/ILLNESS INVESTIGATION REPORT

Employee Name _____ Position _____

Date of Birth _____

SSN _____

Date of Incident _____ Time _____

Accident Location _____

Length of Employment with HAI _____

Length of Time at Job Site _____

Time Shift Started _____

Full Description of Incident _____

What factors led to Incident _____

What Equipment or Machinery was involved _____

What Personal Protective Equipment was Employee wearing _____

Describe Weather Conditions and Terrain _____

Follow up Actions Required _____

Additional Concerns _____

Did Employee Receive Professional Medical Attention _____

Was Employee Hospitalized _____

Name/Address of Hospital/Clinic _____

Name of Physician _____ Telephone _____

Was a Health and Safety Plan prepared for this project _____

Was an on-site or interoffice Health and Safety meeting held for this project _____

If so, When _____

Who attended _____

Employee Statement _____

By _____ Signature _____ Date _____

Witness Statement _____

By _____ Signature _____ Date _____

Project Manager Statement _____

By _____ Signature _____ Date _____

HSO/HSM Review _____

By _____ Signature _____ Date _____

OSHA Recordable Incident _____

OSHA forms 101,200 Properly logged _____